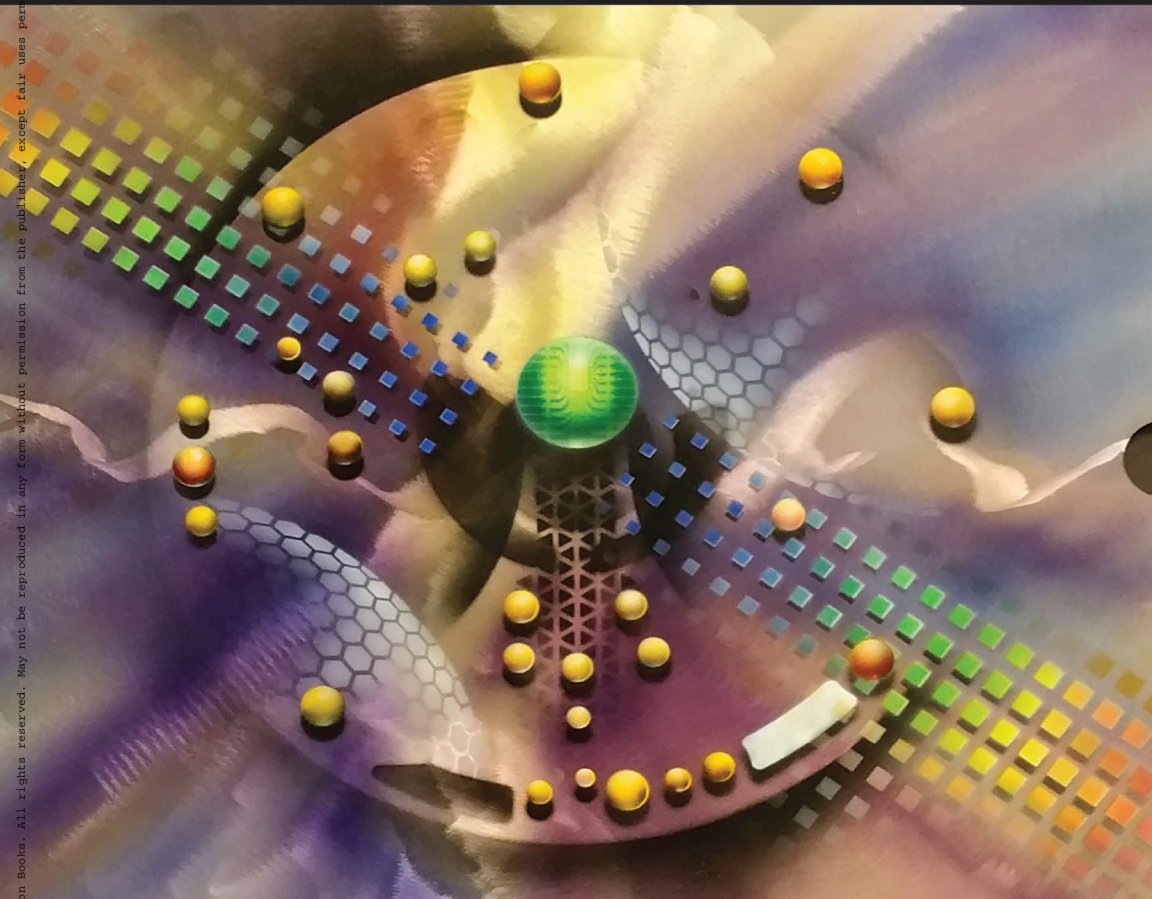


BETWEEN SCIENCE AND SOCIETY

CHARTING THE SPACE OF SCIENCE FICTION



DOUGLAS A. VAN BELLE

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Between Science and Society

Charting the Space of Science Fiction

Douglas A. Van Belle

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Introduction

Heresy as Method

The most significant obstacle confronting the academic study of science fiction and the linkages it creates between science and society is the academic study of science fiction and the linkages it creates between science and society

—Author's Name Withheld

While the author who made the claim that the academic study of science fiction is its own worst enemy was clearly trying to be provocative, those who consider it to be flippant or in some other way inappropriate may wish to take a moment to reassess or at least temper that reaction. There was nothing offhand or good-humored about the way the author who was about to be interviewed made that statement, and, despite some recent shifts in academic approaches and perspectives and some improvement in the way academic researchers engage the genre, there is still a disturbing degree of substance behind that statement that makes it both significant and problematic. From historical grudges, to ivory-tower tribalism, to research paradigms and analytic logics that are incompatible with the ideals of what might be one of the most idealistic of genres, the unfortunate reality is that we still have a lot of road left to travel before we can leave behind what is now over a century of hostility, conflict, distrust and dysfunction between academia and the artists who write science fiction.

The introductory quote as well as the other expressions of dissatisfaction with the academic approach to the genre, only a few of which I note in this introduction, were spontaneous, and many were offered as we set up for the interviews, after the interviews, or in some cases in response to the initial request for an interview.¹ In addition to the spontaneous nature of these

comments, the passion behind the expression of some of these comments was striking.

Mostly I just find that the conventional literature professors simply don't know anything. There was one, (name redacted), who has obviously never really read any science fiction and is now writing criticism books about Science Fiction.—
Author's Name Withheld

Most of these people are rather worn out post-modernists that simply seem to hate something that they don't understand, or maybe they hate it because they can't understand it . . . And they have the gall to say that their interpretation of what I wrote is more meaningful than what I actually wrote and then they twist that around to put words in my mouth. Hate the bastards, and you can quote me on that.—Author's Name Withheld

The disrespect that science fiction is shown on university campuses simply reflects the stunning, myopic stupidity of most literature professors.—Author's Name Withheld

While the words chosen by the authors quoted might seem striking, the sentiment expressed appeared to be closer to the median rather than to the extreme, and this selection includes neither the most vitriolic nor the most colorfully worded comments. Whether it was in the reasons offered for their reluctance to grant an interview to an academic researcher, or in the way a kind word was offered for how they felt that this approach differed from most, or simply a taking moment to vent some pent-up frustration, in one way or another, some variation of these or similar sentiments was expressed by the majority of the authors interviewed.

These reactions do not arise out of a vacuum. It's no secret that the hostility that academics have directed toward science fiction stretches back to well before the notion of genre even existed. Luckhurst (2005) offers a succinct description of this conflict, placing it in the context of the Industrial Revolution's creation of a literate workforce and the resulting rise in the production of reading materials meant to entertain that working-class audience. The stories that would later be called science fiction were prominent in those publications, as were some of the early science fiction authors. H. G. Wells, as an example, both wrote what would become some of the great works in the genre and participated in some of the early debates over the nature of literature itself. The fact that so many of Wells's stories explored the human and philosophical implications of the mechanization of society in ways that can only be called literary complicated academic efforts to distinguish elite-oriented works from mass-market fiction, and may have been

the catalyst for the following century of conflict. The result of the effort to exclude science fiction along with other writings oriented toward that newly literate, working-class mass market became what can only be called a sustained, elitist, academic denigration of the genre.

This was far less of an issue with the youngest of the writers interviewed and that indirectly supports Luckhurst's (2005) claim that there has been a recent but significant shift in the academic approach to the genre. However, it is fair to say that the long-standing estrangement of science fiction and academia is still a significant issue, and it presented a substantive impediment to what should have been a simple and straightforward set of research interviews. In the end, even though this is not and was never meant to be an engagement with that conflict, the lingering hostility still influenced both the conduct and the resulting products of this study.

This history of hostility created difficulties in just securing the interviews. Several authors were reluctant to participate until they were assured that I was not a film or literature professor, and more than one of the authors included in these interviews initially declined to be interviewed, but later reached out to me to set up an interview and explained that the change of heart was a result of hearing from another author that I had published a few science fiction novels of my own and that the intent of the project was to, as faithfully as possible, document the perspectives of the authors. The prioritization of the authors' perspectives had always been part of this study. As part of a broader research project delving into the social and political dynamics inherent in the relationship between science and society, the goal was to find out how the authors conceptualized their role in that space between science and society and explore how that conceptualization might translate into their conceptualization of the genre. It was expected that this would then translate into a way of engaging constructively the authorial intent that influenced their choices and actions as writers. However, as the process of conducting the interviews unfolded it became clear that prioritizing and documenting the voice of the authors, in as raw a form as possible, needed to be the primary focus of whatever I produced from these interviews.

Many of the authors explicitly, and wholly unprompted, said that my intent to try to faithfully represent what they actually had to say was the only reason they agreed to participate. Others commented on how the literary analysis of science fiction seemed to be the only academic study of an artistic endeavor where the analysts disregarded or disparaged the skill and professionalism of the masters of the craft. This line of commentary didn't just reflect the hostile comments that academics have historically directed at the genre and its products; it reflected a clear belief held by these authors that essential aspects of the genre were being missed or completely dismissed in academic analyses. There were several variations of these kinds of comments that occurred

within and around the interviews. Many authors mentioned how frustrating it was to put so much time, effort, training, and skill into crafting every element of a novel so that it said exactly what they wanted it to say, only to have some academic come along and casually dismiss their professionalism, skill, and intent as an author. Others, often those whose comments were more focused on the genre as a social phenomenon, expressed bewilderment over what one of those authors described as academia's "Breathlessly self-congratulatory ignorance of Science Fiction offered as a virtue of paternalistic elitist pretensions."

Again, much has changed over the past few decades, and that change is continuing. The increased and increasing levels of engagement by persons studying the genre in the academic conference that is traditionally held in conjunction with the World Science Fiction Convention (World Con) are a clear indication of this change. As recently as 2010, the academic research presented at World Con might have best been described as recent work on the sciences related to science fiction, with a couple of papers presented about the genre. In contrast, in the 2019 World Con's academic track, a slight majority of the presentations were on studies of the genre and as the academic conference for 2020 takes shape, that appears to have become the new norm. In fact, for the 2020 academic conference, so much of the research is focused on the genre, that the academic track was renamed as "The academic and science track" in order to assure those conducting research in science related to science fiction that they still had, and would continue to have, a place alongside academics who were studying science fiction.

That is a remarkable shift to see in just a decade, but what makes it significant in this context is that it is hard to imagine an academic researcher presenting their work examining the genre at World Con if they are hostile to science fiction as a literary genre, or dismissive of the values of science fiction, or contemptuous of the skill and professionalism of the masters, or even just disconnected from what is valued by those who are deeply engaged in the genre. Further, that engagement and respect for the genre is qualitatively apparent in the academic research which is presented at World Con. It is difficult to quantify or otherwise identify the source of that impression other than to suggest that part of the answer might be found in which texts are selected for study but there is a clear qualitative contrast to conferences where there is no expectation that elite authors and others who are deeply engaged with the genre will be in the audience. That might be taken as further indication of that change that Luckhurst (2005) discusses. However, the fact that it still feels like a contrast to the research on science fiction that is presented in other academic conferences might also be an indication that the self-congratulatory ignorance noted by one of the authors is not about to fade quietly into the history of the academic study of the genre.

The obstacles that have been thrown in front of this study, even before it was initiated, might also indicate there is still some distance we need to travel before we leave that history behind us. What should have been a simple bureaucratic formality of documenting how some contractually guaranteed university research funds were going to be used to conduct the interviews for this study turned into a battle with one of the relevant committees when they refused to wield the rubber stamp. That committee had regularly signed off on projects that studied the works or authors of pretty much every other genre imaginable, but for this study, a significant effort had to be invested in demonstrating that a study interviewing science fiction authors about how they conceptualized the relationship between their work and science was a legitimate area of academic research.

Some of the reviewer responses to an early paper written from these interviews bordered on the mind-blowing in terms of both the inherent hostility toward the genre and the intellectual hubris of the anonymous reviewers. As is always the case, the majority of the comments were fair, constructive, and helpful, but the comments made in a significant proportion of the reviews were astounding. Most common was some variation in the assertion that the perspectives of these authors were irrelevant to the study of the genre. These included several variations on the claim that Barthes (2001), Foucault (1979), and others had long ago established that authorship was irrelevant—an assertion difficult to accept in light of subsequent shifts in theories of authorship (Compagno 2012)—as well as one rather bizarre assertion that these elite science fiction authors were in some way ignorant of the nature and values of science fiction as a genre.

While not all of the authors interviewed here made negative or derisive comments about the academic study of science fiction, for those who did it was precisely those two points that seemed to be at the crux of their dissatisfaction. Almost all who made a negative comment bristled at the idea that their authorship, intent, skill, artistry, and craft were irrelevant. Comments stating or intimating that academics didn't understand the values that define the heart and soul of the genre, or that academics didn't even know what science fiction was, were even more common. Those also arose in the asides and conversational comments of authors who weren't overtly expressing frustration with the academic study of science fiction. Often this was a remark expressing confusion about works selected for study, a work offered as representative of a certain aspect of science fiction, and in one case a teasing, sarcastic comment that it would be a nice change of pace to talk with an academic who understood that science fiction was more than H. G. Wells, Ursula K. Le Guin, and obscure French novels that no one had ever even heard of.

The first of these frustrations is addressed by privileging the author's voice as a key fundamental of this project. This is done through the structuring of

the presentation of the information gathered as well as the subsequent analysis. While this inherently rejects the extreme interpretations of the debate over the death of authorship and denies claims that it is the text and only the text that matters, this is not meant as an assertion that the author is the only thing that matters. Instead, it is an assertion that authorship and the self-conceptualizations associated with authorship are significant, while intentionally leaving open the question of the extent to which authorship should be balanced against the interpretations and constructions derived from the texts (Compagno 2012).

The second of these frustrations is addressed by concluding this study by using the content of the interviews to inductively derive a working definition of science fiction from the comments made by these authors. This turned out to be something of a natural product of these interviews because it was common for authors to describe or discuss how they conceptualized the linkage they provided between science and society in terms of those linkages simply being something inherent to science fiction itself. As a result, the exercise of mapping out how their comments describe that conceptual space between science and society tended to lead naturally toward a definition of the genre. While this definition shares some similarities with academic definitions, the divergences are meaningful, particularly in terms of the two critical ideals that define the center of the genre, the accepted vagaries of certain borders between science fiction and other genres, and what distinguishes science fiction from other texts that link science and society.

HERESY AS METHOD

There is no simple answer to how this study should fit into the mix of positive change and a lingering, problematic history. There is also no obvious way to position, present, or frame it to best convey what it has to offer by prioritizing the perspectives of the authors, so the decision to conceptualize it as a challenge to an academic orthodoxy—or to put it crudely, an act of academic heresy—might best be considered an imperfect compromise. The primary intent of choosing this approach is to facilitate the ability of others to evaluate or use this material in a manner that they feel is most appropriate without trying to anticipate what aspects of what these authors have to say will be significant to their research. This choice does not arise out of a vacuum, and it has proven to be reasonably effective in accomplishing exactly that goal of empowering those who might use the text and the information it offers in unanticipated ways.

This idea of a heretical mindset is an adaptation of the example offered in Robert Bakker's *The Dinosaur Heresies* (Bakker 1986), and it has previously

been applied to areas of study in the social and political sciences (Van Belle 2006, 2008, 1997, 2015). These earlier efforts extended some of the underlying elements in the way the post-structuralist intellectual tradition had been applied to the study of foreign policy and international politics (McGowan 1989; Ashley 1984; Soguk 1999). Specifically, a deliberate effort was made to deconstruct the way that existing structures of inquiry defined the questions that could be explored. However, unlike the post-structuralist approach as applied in the social sciences, the deconstruction was a starting point rather than the goal. In the previous applications of this “heretical approach” (Van Belle 2006, 2008, 1997, 2015), the deconstruction was used to dig down as close as possible to first principles, then question, rethink, and sometimes discard the presumptions or assumptions of the theories that initiated the line of inquiry and then from there construct an alternative theoretical model as a way of generating new perspectives and, hopefully, fresh insights into persistent and vexing puzzles.

Here, however, the heretical approach means more in terms of mindset than practicalities because little, if any, deconstruction of the academic approach to science fiction was necessary. While it is clearly a gross exaggeration to say that the perspectives of the people creating science fiction have been excluded from the academic engagement with the genre, their perspectives certainly have not been integral to much of the theorizing and other intellectual foundations that define the various academic perspectives. As an example, a 1992 collection of essays about the genre, written by some of the more prominent science fiction writers at the time (Jakubowski and James 1992), has been cited only six times, and not at all in peer-reviewed research.² As a result, these largely excluded voices can be treated as just that, largely excluded, and a reasonable alternative to the existent academic perspectives can be constructed simply by treating the situation as if the slate were blank and working just from the comments of these authors.

Additionally, the argument central to John Platt’s strong inference (Platt 1964) plays some part in how these interviews are presented and then analyzed here. Platt argued that getting buried or lost in complex abstract academic debates was one of the surest ways for the pursuit of knowledge to go nowhere, and the best way to understand something was to focus on what people actually do and what they are trying to do. Platt was talking about the academic struggle to conceptualize how science progresses, but the same idea of first asking what people do or are trying to do applies here. In this case, the questions to be asked are: Who are these authors? What do they intend to accomplish with their writing? And, how do they conceptualize that intent? Their answers then outline their understanding of science fiction as part of the mediated space between science and society, what it looks like, and how it functions.

The analysis that is produced from these interviews is presented as a charting exercise, a mapping of the conceptual space of science fiction that offered a way of linking the comments of the authors to the academic study of science fiction, and it naturally culminates with the inductive derivation of a definition of science fiction that might be a useful mechanism for bringing authorship back in on the terms of the authors. However, this project can also be treated as, for lack of a better term, a data set. The interviews are presented with as little editing and commentary as possible, staying as close as possible to the transcripts while still making them readable. To protect the respondents and the occasional person they mention, a few comments and asides are excised (some of which have already been presented without attribution), but a meticulous effort has been made to ensure the presentation of these interviews matches what the authors intended to say.³ The interviews are then used as the foundation for charting the conceptual space of science fiction and analyzing what insights might be gleaned from considering that exercise.

For academics that definition might be particularly interesting in the way it identifies where the authors accept ambiguity and indistinct boundaries as inherent to the genre, and where they draw clear lines or have clearly necessary requirements for what must be included in any definition. However, even in that, the derivation is being offered as an example (and perhaps a provocation) rather than definitive. It is also offered as a complement to what exists and might best be approached as an additional perspective on topics that are addressed by extant research.

The obvious critique that will arise is that this study's engagement with the extensive and diverse body of existing research on science fiction is limited and superficial. That is valid, but that is also the point of a heretical approach. The idea is, to the extent it is possible, to create this charting of the space independently of the literary study of the genre and independently of the examination of the communicative roles of science fiction, and there are good reasons to make that effort. First, any direct engagement of exemplars of, or from within, the history of academic hostility and outright disdain for the genre will serve to situate this material within those frameworks. That will then undermine the effort to treat this as something close to a blank slate in order to prioritize the voices of the authors. Second, there is a desire to respect and complement the existing research literature, particularly the work that has embodied the shift in approach over the past few decades. That is pursued here by refusing to presume how, when, or if this representation of the authors' perspectives might prove valuable.

While some will react poorly to this, the intent is to be complimentary and constructive by offering an alternative perspective that can be used as a foundation for conceptual triangulation as we all strive to leave that history of conflict in the past. Scholars can deconstruct texts in countless ways, as has

often been done in the study of representations of the scientist and science in science fiction (i.e., Petkova and Boyadjieva 1994; Long and Steinke 1996; Van Gorp, Rommes, and Emons 2014). However, even though the clash between academia and the genre has faded over the past few decades, the extreme variety of interpretations that can be derived from those deconstructions remains problematic. It is hoped that adding more information regarding authorial perspectives and keeping that information as independent as possible will add to the more common examinations of the film and fiction texts by offering an additional dimension of information and contextualization.

An additional consideration that probably should be included when making judgments about the extent to which the authors' perspectives are relevant is that when science fiction is considered in terms of the sociopolitical communication roles that it might play, the social and political intent driving these authors' representations of futures or imagined universes is a profoundly salient part of their creative process. In fact, it is such a common feature of science fiction that some might consider authorial intent to be a defining aspect of the genre. The most obvious examples can be seen in the cautionary tales that have been essential to the genre from its earliest incarnations. While it can be argued that all writers have a point to make and as such are writing with intent, the salience of the science fiction authors' desire to warn us in those cautionary tales, or otherwise influence how our future unfolds, may be unique to science fiction.

As quickly becomes evident in these interviews, the ways in which authorial intent manifests itself in the genre are as boundless as the stories themselves. As Kevin J. Anderson notes in the interview, when science fiction authors translocate socially contentious, controversial, or emotionally charged topics such as race or same-sex relationships onto safer subjects such as robots or aliens, they do this with the specific intention of creating the social and conceptual distance needed to more dispassionately explore the related social, moral, and political implications. David Gerrold talks about how utopian visions of the future—such as the central conceit of Gene Roddenberry's *Star Trek* (Roddenberry 1966)—are created with explicit intent to inspire those who would help attain them. David Brin notes that his stories about challenges to the very survival of our species, such as *Earth* (1990) or *Existence* (2012), are offered as investigations into how we might be able to overcome those looming crises. Implications of certain technologies, the effects of technologies on the human condition, or the very nature of humanity, all of those aspects of science fiction add an additional level of intent in the writing of a story, and in many ways they also represent the heart and soul of science fiction.

Science fiction novelists so often write stories that carry that extra level of social and political intent that any reasonably informed reader of the genre

would consider it odd that the perspective of the author, including their understanding of the space they are writing in and from, is not considered as an essential element of the academic study of the genre. That intent is part of what defines how the genre exists in the space between science and society and it defines what it is. It is the bedrock of how the artists that drive the genre conceptualize their place and role in that social, intellectual, and sometimes physical space between science and society.

This study explores these questions by asking the authors and then roughly mapping out, or charting, a few key aspects of how those authors describe the space of science fiction.

NOTES

1. Despite the fact that the authors offered these comments proactively and all explicitly said that I could quote them on these points, any quote that might negatively impact the future academic analysis of these authors' works is left unattributed as a reflection of the "all due care and caution" parameters for avoiding harm, as per the human subjects approvals for this study. Also, unless authors expressly indicated that I could quote them, I do not include any statements, attributed or not, that occurred outside of the interviews.
2. As indicated by a Google Scholar search conducted on May 20, 2019.
3. The authors were also provided the edited transcript of their interviews and were given the opportunity to request changes or add footnotes to clarify points.

Chapter 1

The Interviews

There is nothing simple about the logistics of arranging and conducting interviews with twenty-four elite science fiction authors,¹ and the rather formidable challenge of securing the interviews is one of the factors that should be considered when assessing the generalizability and applicability of anything derived from this study. While the “I wish you would have interviewed. . .” comment is probably one of the most frustrating and unhelpful criticisms that can be offered, it is still important to acknowledge that who was interviewed and, perhaps more importantly, who was not interviewed are significant considerations.

Focusing on elite science fiction authors will tend to produce an older pool of respondents, and this may be even more pronounced for science fiction than for other genres. In addition to the fact that in most instances it simply takes a great deal of time as a contributor to the genre in order to become elite or prominent, it was also common for the journey into the profession of writing science fiction to pass through at least one other significant career or extended diversion along the way. Elite science fiction authors can also be difficult to engage in order to discuss an interview, and simply being able to contact the authors to request the interview was one of the more significant factors that shaped the pool of respondents.

In the end there were only two authors who were asked to participate but were not included because they declined to be interviewed. Instead, the most significant factor limiting the inclusion of study subjects was the ability to establish a line of direct communication with the author in order to request the interview. Almost all of the authors who might be reasonably considered to be masters of the genre, prominent, or elite writers have some form of firewall insulating them from casual correspondence from the public and fans. Sometimes this firewall is as simple as a query form on a

website, but it is often significantly more than that. While personal contacts and previous interactions with several prominent authors made it possible to sidestep many of these obstacles, some of the authors that would ideally be included in any selection of elite science fiction writers are essentially unreachable, and trying to engage them through their literary agents is a fruitless exercise.²

It is impossible to determine if there are any systematic differences between the authors interviewed and the authors who could not be contacted. However, introductions made through a cascade element of the respondent selection process, where participating authors offered introductions to others, made it possible to include interviews from several authors who had otherwise unbreachable firewalls. There was nothing obvious in either those interviews or in the ancillary conversations surrounding the interviews that suggested that an author's decision to erect a significant firewall to isolate themselves was associated with anything consistent in their experiences, attitudes, or beliefs as a writer. When queried at the conclusion of the interviews, authors with significant firewalls all said that the only reason they limited unsolicited contact was to reduce distractions and better manage their time.

For a variety of reasons, not the least being the unsettled politics of the genre in 2015 and worries over being harassed, the difficulty in contacting prominent female authors was notable. The World Science Fiction Convention in 2015 was probably the peak of the "Puppies" movement, and there was a notable right-wing misogynistic faction that was engaged in an effort to game the Hugo nomination process to hijack and disrupt the most coveted awards in the genre. While almost none of the members of that movement actually attended World Con, it probably did have an effect because it was possible to work through the firewalls of several of the prominent male authors to secure interviews, but that was not possible with female authors. The only way to make contact with prominent female authors was through personal introductions made by other prominent authors.³

In addition to the two authors who declined to be interviewed, an additional two agreed to participate but logistical issues made it impossible to coordinate a workable time and means to conduct the interview.⁴ Interview requests made through literary agents or managers resulted in no interviews. It is unclear if this is or is not significant. In the three instances where an introduction to one of these authors was later made by a participating author, none of the authors who had been approached through an agent or manager had received the interview request from their agent. Thus, other than the one author who declined through her agent, it is unclear how many of the other ten requests made through agents were actually declined by the authors themselves.

The twenty-four authors interviewed were:

Kevin J. Anderson
Steven Barnes
Greg Bear
Gregory Benford
Ben Bova
David Brin
Brenda Cooper
Stephan R. Donaldson
Eric Flint
David Gerrold
Joe Haldeman
Ian Irvine
Nancy Kress
Jack McDevitt
Rebecca Moesta
Simon Morden
Larry Niven
Robert J. Sawyer
Karl Schroeder
Melinda Snodgrass
S. M. Stirling
Charles Stross
Vernor Vinge
Connie Willis

People who are familiar with the genre will recognize most of those names, though a few will probably be unfamiliar. With the study focused on how elite authors understand their role in the conceptual space between science and society, an effort was made to represent the breadth of the genre by bringing in top writers from across the variety of significant subgenres of science fiction. Rebecca Moesta may not be a Hugo winner, but for those who are familiar with youth and young adult science fiction novels, she is both prominent and prolific. Similarly, Karl Schroeder is one of the better-known futurists who writes science fiction.

When it's noted that some authors have made significant contributions in more than one subgenre, such as Robert J. Sawyer as both a hard science fiction novelist and a screenwriter, the interviews include at least two authors with significant contributions in each of the following areas: hard science fiction, sociological science fiction, gender-/sexuality-focused science fiction, science fiction for the screen, alternate history, youth and young adult science

fiction, futurist science fiction, and space opera or epic science fiction. Only one author who considers most of his work to be cyberpunk (Simon Morden) is included, though an increasing amount of Charles Stross's work could also fit that subgenre. Further, with degrees in computer science and pharmacology, Stross claims to be the world's only fully trained cyberpunk author. Two authors who are primarily known for their fantasy works, but also write science fiction, Ian Irvine and Stephen R. Donaldson, are included as a point of comparison. The one real disappointment in trying to engage the breadth of the genre was that it was not possible to secure any interviews with authors who primarily write steampunk.

Other aspects of diversity may be a concern for some. While the sample does include one of the first openly gay science fiction authors, that does not change the fact that the majority of the authors included are older white males and, while there has long been a preponderance of white male authors occupying the ranks of elite science fiction authors, to have three-quarters of the respondents in that demographic category is problematic. It would be preferable to have a more diverse set of authors included; however, when it comes to securing interviews, particularly with elite authors or others who are prominent, what is preferable and what is possible are two different things.⁵ Cixin Liu won the Hugo for best novel in 2015, which was the year these interviews were conducted, but he was not at the convention and to this day he is difficult to the point of impossible to interview.⁶ Even working through the introductions made by several of the participants in this study it is notable that N. K. Jemison, Ann Leckie, Jo Walton, Paulo Bacigalupi, and Vonda McIntyre, and several others simply could not be contacted.

Judging by recent trends, with the last six Hugo Awards for best novel going to women, a person of color, and a Chinese author, the limited cultural diversity of this group should be considered when applying the material from this study and in planning future studies.

INTERVIEW STRUCTURE

The interviews were conversational and loosely structured around six questions and prompts. The respondents were told in advance that the interviews were part of a larger effort to explore the social dimension of science fiction in relation to science and society. Respondents were encouraged to take the questions or prompts in any direction they wished, and they were told that the direction they took in their response was as significant as the substance of what they said. They were also told not to worry if they had little to say in response to a question or prompt, or if their answer grew and wandered. If

a question led to a story, or an anecdote, or a rant, they were encouraged to share, no matter how tangential they thought it might be.

The majority of the interviews were conducted at the 2015 World Science Fiction Convention in Spokane, Washington. Additional interviews were conducted via Skype or by phone in the weeks immediately following the convention. The generosity of these writers cannot be overstated. Their schedules at conventions are hectic to the point of insane, but nearly every writer I asked found a way to carve out the time for an interview. Many cut a lunch short or arrived as much as an hour before the doors opened in the morning just so we could find the time to sit down and talk. Some even went so far as to help me arrange additional interviews with authors who are difficult to contact or who were attending the convention but were not listed as a participant in the schedule. Melinda Snodgrass deserves additional recognition on this point. She put a remarkable amount of effort into assisting in this regard.

A brief summary of my academic and fiction writing credentials and background was included as part of the official request for interviews and that led to one additional factor that seemed to have a consistent effect across many of the interviews. Prior to the interviews, I had published a modest amount of science fiction in Australia and New Zealand, including a couple of novels with small presses. While I was clear about the limited nature of my accomplishments as a science fiction author, many of the authors found it reassuring that I wrote and published fiction and that I wasn't just studying the genre. This included a few who said it was the deciding factor in their decision to participate in the study. Presumptions related to that shared experience as writer seemed clear in the face-to-face interviews, and it probably influenced some of the comments made.

The following questions, prompts, and occasional sub-prompts were used to very loosely structure the interview. In almost all cases, for almost all of the questions, the authors responded with a direct answer to the initial prompt and then offered more. It was often in the additional storytelling, explanation, contextualization, or the occasional rant that they offered the most interesting commentary regarding how they conceptualized their place in the social, cultural, and sometimes physical space between science and society. It was also common for the writers to "answer" what would be a later question or prompt in response to an earlier question or prompt. When that occurred, they were encouraged to expand or refine the earlier comment when we reached the subsequent question or prompt.

The questions and prompts used were the following:

1. Origin Story. Tell me your origin story. Maybe start with that first memorable science or science fiction moment.
 - a. Prompt if formal education isn't mentioned.

2. **Compromises on Science:** Are there any times where you've had to compromise the reality of science or the scientist in order to tell the story?
3. **Interactions with Scientists:** Do you interact with scientists and is there anything significant about your interactions with them that impacts your writing?
4. **The Teaching Moment** (*This was purely a prompt and the respondents are told before it is offered that the variety of things brought to mind by the prompt is a big part of what is interesting.*)
5. **Between Science and Society:** How do you see your role, or your work in the space between science and society?
6. **What Should I Have Asked?** What is the question you think I should have asked you, but didn't?

The resulting interviews varied widely. A couple were only about fifteen minutes; some went two or more hours. There was also a huge variation in where these conversations went after that initial request for their origin story. Despite that, there are several intriguing commonalities that resurface repeatedly and are discussed in later chapters.

It is also notable how frequently the commentary in the origin stories or the response to the compromises on science or the scientist question answered the subsequent questions or addressed the subsequent prompts. The “interactions with scientists” question was almost unnecessary as was the “What should I have asked?” question.

INTERVIEWS AS A RESEARCH TOOL

The advantages and issues related to using interviews as a research tool are well known and well covered in undergraduate methods textbooks (i.e., Babbie 2010; Creswell and Clark 2017), and it is seldom necessary to discuss the methodology beyond a basic outline of the intent, design, and means of conducting the interview (Kvale 1996). However, for the approach adopted here, particularly since largely unstructured interviews can produce messy and wandering commentary and the transcripts are being presented with only minimal editing, and without immediate analysis or interpretation, some additional commentary on interviews as a research methodology, and some details regarding the specific choices made in the design of this study may be useful.

The key advantage or value offered by interviews as a methodology is that they enable the respondents to “speak with their own voice” (Berg

and Lune 2007, 96). While that basic idea may be worded differently in different textbooks and methodological discussions, it is the central element of the methodology. The degree to which the respondent's voice is actually represented varies with the structure and nature of the interview (Alshenqeti 2014). When it comes to enabling respondents to speak with their own voice, less-structured interviews, particularly where the respondent is encouraged to take the commentary where they wish, are considered best practice. That is why the "What should I have asked?" question is valuable, even though it seldom adds much to the interviews. That prompt enhances the validity of the representation of the respondent's beliefs by offering them the explicit opportunity to take ownership of the interview by summing up their thoughts or concluding the interview with any comments or queries that have come to mind (Talmy 2010). These factors were salient considerations not only in the choice to use a largely unstructured conversational interview technique but also in the choice and ordering of the prompts used in the interviews. Opening with the origin story prompt was used to contextualize the interview in the respondent's history, encouraging them to take ownership from the start, further enhancing the effect of the final question.

Using less-structured conversational interviews, where the respondent is largely responsible for assembling a coherent narrative, reduces the likelihood that the interviews are capturing the superficial, reflexive responses that are a concern with highly structured interviews that demand answers to highly specific questions or limit the range of possible responses (Galletta 2013). Concerns with the potential for superficiality in these responses was also addressed through the invitation and process of arranging the interviews. The process of securing the interviews clearly indicated the intention to explore how these authors conceptualized their role in the conceptual space between science and society. In addition to the time between arranging and conducting the interviews, the authors were given research information packages when they sat down for the interview. Those packages reminded them of that information, and they were given some time to consider the interview's general research purpose during the setup for the interview. They were also given the opportunity to ask questions before the interview commenced.

Avoiding highly structured questions and response matrices that might unintentionally imply that there are correct answers to the questions is also a way to reduce the impact of authority structures in conducting research. This was also a consideration in the conversational nature of the interview, as well as in the efforts made to encourage the respondent to take ownership of the conversation. All of those elements serve to reduce the likelihood that

respondents might be consciously or subconsciously seeking the “correct” answer (Babbie 2010).

None of the wide range of methodological concerns that might be relevant with interviews can ever be eliminated; they can only be reduced or minimized, but those steps to minimize those issues have been taken and the basic approach of using largely unstructured interviews is the best available technique for engaging the perspective of these authors. Also, presenting the transcripts before analyzing or interpreting them is an additional part of the effort to faithfully represent their perspectives and their voices.

The interviews are presented in alphabetical order.

NOTES

1. These interviews were conducted under the purview of the Victoria University of Wellington’s Human Ethics Committee, approval number 21821, and the study as well as follow-up inquiries made to the authors employ all relevant procedures and safeguards for the protection of human subjects, including confirmation of informed consent.

2. Some of these unreachable authors were still included through introductions made by participating authors.

3. Melinda Snodgrass deserves a thank-you in this regard. She went out of her way to help me secure interviews with both Connie Willis and Nancy Kress.

4. Elizabeth Moon and Jerry Pournelle agreed to an interview, but we were unable to manage the logistics. Ursula K. LeGuin declined due to poor health, which she conveyed with a kind note sent through her agent. The other author who declined cited previous conflicts with academics, using quite colorful language, and for that reason will have to be left unnamed.

5. The one failure on this point was that Tananarive Due was available for an interview at the 2015 World Science Fiction Convention, but I failed to lock down a specific time before her schedule made it impossible to find a time.

6. It is worth noting that I spent part of 2016 as a guest faculty member at Nanjing Astronomical and Aeronautical University and did attempt to secure an interview with him at that time. Even with the help of my host, it was not possible to even make contact.

Chapter 2

Kevin J. Anderson

If people understood the basics of science, the basics of physics, then so many of our other problems would cascade into solutions.

—Kevin J. Anderson

As part of my association with Avalon Film and Television Studios, I had previously corresponded with Kevin a few times about adapting some of his work to the screen. During those exchanges we occasionally discussed other issues related to the film and television industry. As is so often the case with film and television, it quickly became apparent that some of those other issues would make it difficult to get any of his work in front of the camera at Avalon, and we ended those discussions about a year before the interviews took place. The correspondence related to the studio was limited, and it would be a stretch to even say that we had even become acquaintances, but it did make it easy to contact Kevin and he was one of the first to agree to an interview.

Prior to meeting Kevin face to face, I knew that he was a prolific writer. From extending the *Dune* (F. P. Herbert 1965) series with Brian Herbert, to his multivolume *Saga of the Seven Suns* (Anderson 2003), to his *Dan Shambles* (Anderson 2012) zombie detective series, to co-authoring young adult novels with Rebecca Moesta and additional projects, his productivity cannot be described as anything less than astounding. His publication rate is even more impressive when it is added to his work as a publisher and the time he invests promoting the Wordfire Press imprint and its authors. Knowing that, the high-energy and focused man who sat down for the interview was about what I expected. What I hadn't anticipated was how effortlessly he

expressed himself. It may have been obvious that a man who could write at the pace that he does would be gifted when it came to transforming thoughts, ideas, and stories into words, but writing and speaking are often two far different things. Writers as a whole tend toward the introverted side of things and even casual conversations with them are often challenging, but that wasn't the case with Kevin.

Due to several interruptions that occurred during the interview, this interview required more summary and annotation than most.

ORIGIN STORY

DVB: The story of how Kevin became a writer starts at the age of five with the classic 1953 *War of the Worlds* (Haskin 1953) film. When he mentions how overwhelmed he was by the film, he rolls his eyes a little and makes a little gesture to show that he was just as much terrified by it as he was fascinated. From that time on, he was hooked on both science fiction and science and he mentions two points that are frequently mentioned by all of the authors. First, he became an obsessed consumer of science fiction tales. He preferred the screen over reading, but he did indicate that he read prolifically. He also began trying to write stories before he was really capable of writing and went on for a while about trying to convey those stories through everything from drawings to puppet shows.

His education included majors in physics and astronomy, both choices he credits to his love of science fiction. After finishing college he worked for fourteen years as a technical writer for a large government research lab and, as he discusses his path to becoming a science fiction writer, emphasizes how that experience gave him the opportunity to work closely with a large number and a large variety of scientists, and how it exposed the dissonance between the scientist in fiction and in reality.

KJA: In fiction, scientists are often eccentric geniuses who can screw a few things together and save the world. Working in real science, there was as much politics as there was science. There wasn't as much innovation and leap of faith, it was more gigantic plans with milestones and budgetary meetings.

I was a technical writer, and I really enjoyed writing and I must have been pretty good at it because they kept trying to promote me, but I didn't want to be promoted. The only promotion path from technical writing was into management and I didn't want to be a manager, I wanted to be a writer. The same thing happens to scientists, the best scientists are noticed and they get

promoted to become managers of other scientists. They get promoted out of science and into management.

COMPROMISES ON SCIENCE

DVB: When asked if there were any ways that the demands of storytelling might have forced him to depict scientists or science in ways that didn't fit with his understanding of the reality of either, Kevin dismissed the idea that he compromised when it came to characters and focused not on science as an activity, but on his representation of scientific knowledge about the nature of the universe.

KJA: Maybe not so much the character stuff but with the actual science I run into difficulty because I know astronomy. I know science, I know the size of the universe and I write giant space empire stories. So unless you want a story where it takes 700 years to get from one planet to another you have to wave your hands and say look I know this doesn't work but for the purposes of my story, I have to have starships that regularly go from planet to planet. If they can't you don't have a galactic empire. But even in that, you kind of come back to the real science. When you do go faster than light, how do you communicate if the communication signal can only travel at the speed of light? How do you do it? I used trees and tried to stick close to what we know about quantum entanglement, and that solution built the story because they can instantaneously communicate over vast distances, but it's limited. It's effectively instantaneous telepathy through saplings that were taken from the original forest.

That's all hand waving for the purpose of the story. However, in my defence and more generally in defence of all writers writing space opera stories set centuries in the future. If I were a person living in the 1700s writing about what's going on around us right now with iPhones and the internet, it would be absolutely incomprehensible.

Interestingly enough, I ran into this problem as a reader with one of my favourite big science fiction authors, Peter Hamilton. Peter has created a universe so big and so technologically advanced that it's almost to the point where I can't understand it anymore. He understands it, but even with my background it feels advanced beyond the point of what everyday people think, and that takes me back to imagining a writer back in the 1800s trying to understand iPhones, cloud services and streaming videos. 1800s to today, that's just a few decades. Start increasing the scale to centuries and I know for a fact that I can't imagine what'll be happening in 500 years.

To circle back around to the actual point, yes I do compromise the science with a bit of what we all know is hand waving at FTL, but to say that you

can't have spaceship that can travel faster than the speed of light, or that you can't communicate faster than the speed of light . . . I don't know, give us 500 years and maybe we'll find a way that's scientifically possible because it works in a way that nobody right now can imagine.

I remember like in the 1980s when I started working in the government lab we had the giant cathode-ray monitors and it was right at the time when the Macintosh was coming out with the colour screen and they were like "do you really need a coloured screen?" Most of us were convinced that green, phosphor dots on a screen was all you needed. And that's barely a generation ago.

I think the ability of human progress to solve problems is amazing. The question really becomes: how does that manifest? As we were talking earlier about the speed of government and the speed of laws.¹ Laws are backward thinking. They look at what a precedent said about how to deal with it and are usually focused on trying to prevent things from reoccurring. Science and technology is forward thinking. It's the effort to do something that hasn't been done before. So it's hard for a law to catch up with new technology because they only look at what was done before and what was done before may not be the same thing. The real obvious thing is look at ebooks and copyright law. I'm an author so I understand that we've got a big problem here if we want to keep authors writing. How does the law take the fact that books used to be physical things where the author received a royalty on every copy sold and translate those laws into a situation where someone says, I purchased an electronic version of the book, so that means I can put it on my kindle, also my phone and also my computer. One book is effectively appearing in three or four places at once, whereas if it's a physical book you would have to buy four different copies of it and the author would get royalties on the four different copies of it. How do we sort that by looking backward?

I know that last part doesn't quite fit the question, but you did say that it was important to go where the question takes me and there's something about the backward versus forward looking thing that is significant there, even if I can't quite put it into words.

INTERACTIONS WITH SCIENTISTS

DVB: Another interruption occurred right after I offered this prompt. Fortunately, it was all but superfluous because Kevin had already mentioned the years working as a technical writer at a major research lab. Later in the interview, Kevin interrupted himself, and said that for this prompt he probably should have added some comments about how he consults with the vast array of scientists he knows and has met over the years.

THE TEACHING MOMENT

KJA: Well I look at, not as a teaching moment for science but as a teaching moment for science, politics, for morality, and other things like that because I can set up a story to address those things, but not really address those things. In this country we're extremely polarized. For our conservatives and liberals and there's a huge war constantly over all kinds of things, and both sides don't often listen to the other side, but if you tell it in a science fiction story and you build up this whole thing you can disguise it long enough so somebody can follow the story and get to a point where they are like "oh, this is a metaphor for something I wouldn't have otherwise thought about." I have a series that's sort of a humorous horror about a zombie that's a private detective, and I had one scene in there where they are this very conservative group that is trying to destroy this mixed marriage between a werewolf and a vampire. The characters are married and they love each other very much but others are trying to tear it down because marriage is defined as one human man and one human woman. Now I've had people read this who are very much against any changes to our marriage laws and they wouldn't even listen to an argument about marriage equality. However, when they are reading a story of a werewolf and a vampire, some of them can see how absurd their position is. In the book, they see that this couple loves each other very much and they think it's terrible that they're being torn apart. They wouldn't think that way if it was being addressed to them as two gay men who want to get married, and it's probably not really changing a lot of minds, but as a metaphor in a story it's at least getting them to engage it a little. So that's a teaching moment.

BETWEEN SCIENCE AND SOCIETY

DVB: Again we were interrupted right after a prompt. As we packed up after the interview, he indicated that he probably should have expanded the idea of translating between two different languages that, for all intents and purposes, are being spoken in two different worlds. He also made it quite clear that he doesn't think of his science fiction as his continuation of his work as a technical writer. He is not writing science fiction to communicate the nature of science to the public on behalf of scientists, but the years spent in that job do provide a foundation of experiences that he considers rare, possibly unique.

WHAT SHOULD I HAVE ASKED?

KJA: This is going to be kind of a chicken out answer, and not really an answer, but I think that our greatest challenge is to get more of the public to

understand even the most basic fundamentals of science. This interview has been about some fairly high-level stuff, intellectually and pretty abstract, and my big worry is about the massive, voting population in this country who believe this earth is only 5000 years old. We're working against vastly more difficult challenges than I think should be even possible. We have so many propaganda information, dissemination systems calling themselves news networks and they will state, nonstop, categorically false things such as the claim that there is no evidence for climate change, or that evolution hasn't been proven. I worry more because those are people raising children and I would be far more interested in trying to help those kids with some kind of basic scientific literacy. I believe that would then start a snowball effect, because if more people understood basic science, basic climate, basic physics, then so many of our other problems would cascade into solutions. Right now, we have scientists spending all of their time and their breath insisting no there really wasn't a magic garden 5000 years ago. I think that if we could get a better, broader, basic foundation, then things might get a little better for us.

NOTE

1. While going through the disclosures, permissions, information sheets, and other such bureaucratic aspects of conducting an academic research interview, we shared some comments on the way the laws and procedures that regulated research, as well as government more generally, were backward-looking embodiments of history.

Chapter 3

Steven Barnes

My goal in life is to create 1,000 awake, aware, adult writers and teachers. I feel that we are at a place right now where just 1,000 people could change this planet for the better.

—Steven Barnes

Prior to our meeting in Spokane, I had never had the opportunity to correspond with Steven. From his social media activities, I had some idea that he was an advocate of what I would call a spirit–mind–body, whole human, philosophy. He discussed spirituality a great deal, always in terms of the human mind and body. He frequently mentioned bettering one’s self in a way that bettered society. His posts and commentary emphasized personal development through both physical and mental training. He would occasionally delve into discussions of racial politics and social issues, but even when discussing some of the significant racial conflicts and injustices of 2015, his emphasis was always on the positive. He expressed anger and frustration, but always channeled into the question of how do we elevate everyone involved? How do we ease the fear and hatred? How do we raise our appreciation of and respect for the racial or social other? He frequently posts the accomplishments and achievements of others as examples he believes have value as lessons or as reminders of the positives in the world around us.

The impression derived from social media turned out to be a reasonably accurate, if limited, representation of the man I met. Steven went out of his way to arrive an hour before the beginning of the second day of the convention so he could squeeze our interview into his schedule. There is a great deal more depth to the spirit–mind–body advocate than is apparent in social media, but that is clearly central to who he is. Initially, that seemed a little

at odds with his science fiction novels, but my introduction to his work was through his collaborations with Larry Niven and, in hindsight, that colored my impression of him as a writer. It set up expectations that influenced my impressions when I later read his solo projects and looking back at *Lion's Blood* (Barnes 2002), I now see far more of the Steven Barnes I met at World Con, than I did when I first read the novel. Another thing that is easy to miss from the persona presented in his social media presence is his sense of humor. There is a great deal of laughter, from both of us, in the recording of the interview.

ORIGIN STORY

SB: It would be a really tough thing to say what was that first thing. Maybe *Mr. Wizard* (Herbert 1951), or some other popular television show, or whether it was watching people shoot off rockets, or whether it was a movie. I love science fiction movies and there was always a scientist in them, and he was always either the hero or the bad guy, and I was really just fascinated by that. I always thought there was something really neat about that, but I really couldn't tell you where that first engagement with science or science fiction occurred or where my interest really came from.

There are only two questions you can ask about life that is ever asked in books or philosophy and the rest. One is: Who am I? And Two is: What is True? What are human beings and what is the world that they observe? I think, that, from a fairly early age I was aware that consensus reality was not accurate. I was aware that I was not what people said I was. There was a gap between the way society represented me and what I was, and I think that that lead me into what has become a lifelong search for what is true, part of which is the question of who I am, who people are.

The interest was just always there. It didn't gel for quite some time because they were fairly mature questions to be asking for a kid. I didn't understand the implications of them. If you follow those questions deeply enough, you'll unravel your ego pretty quick. The process that leads to the state that's referred to as enlightenment or non-dualistic thought are all about unravelling those two things: your identity and your view of the world. So it was sort of an odd path to take, especially that young

To the degree that science is a means of trying to ascertain "What is true?" "What is it out there?" "What are we doing?" the scientific method is the single greatest gift that Europe gave to the world. It is such a powerful tool that it became a thing that I was able to use even in studying metaphysics. To separate my mind between sort of the shaman and the scientist. To understand that there are things I perceive that might be artefact or fantasy. The

idea that some of these “real” things might be projections of my own mind is awesome. I know that it allows me to simultaneously believe things that my logical mind knows I have no evidence for, and still doubt or challenge things that appear to have evidence but might not really be what I am perceiving. I try not to allow them to leak into each other, but the truth is that I don’t see them as contradicting, the way that I look at my universe. In that way, physics and metaphysics become compliments of one another, expanding each other, rather than competing realities.

I know that’s a little wonky. In the technical sense of the term, wonky, of course.

DVB: After an interruption he was prompted to add his educational history and he talked about attending Pepperdine University. He implied that he had a long history of writing prior to college and that was reinforced with some of the brief comments he made when we settled back into the interview after interruptions.

SB: Majoring in communication arts and sciences, I tried to stop writing. My father had been a professional entertainer and his career failed and that probably was responsible, in part, for the dissolution of his marriage to my mother. There was a lot of pain around that stuff. So my mom tried to discourage me from having a career in the arts. So when I went to college I tried to make her happy and I stayed away from writing. I actually tried to stop writing. I kind of stayed away from writing for a couple of years. I was taking journalism classes and radio classes and speech classes and composition classes, just dancing around the edges of writing the whole time. Then they had a short story writing contest and the winners were going to read their stories to an alumni. I was one of the winners and when I read it, I was looking at the audience and looking at their faces and I said to myself, this is what I’m supposed to be doing.

That led to the worst mistake I ever made in my life because I dropped out of college. My teachers there were not capable of finishing their writing. I remember one of them, a very nice guy, who had a book he’d been working on for years and years and years, and he had not been able to finish it. I was afraid I was going to suck up their failure, that they were going to contaminate me. That was a mistake. It would not have happened, and I wish my dad had been in the home because he would have kicked my butt and made me finish.

Dropped out of college and started working. Started getting jobs in the entertainment industry and that was pretty much my life at that point. I would work and write.

It’s maybe a little unusual for a science fiction writer to not have a technical or science background, but the aspect of science that I’m most interested

in is human mental and physical development. I study that intensely, but in application more than theory. Maybe that focus was because I wasn't at school? I don't know, but I would go deeply into things like yoga and read everything I could get my hands on and study what it was culturally and what it was as an epistemological concept, what it was as a bio-feedback mechanism, what it was doing in terms of different metaphors it used for different systems in the body. I went even more deeply into martial arts and that's been a very important part of my life for some 40 years.

It gets a little funny at times. I was invited to an academic conference where everyone else was a Ph.D. and then, there I am. And they treated me as a colleague and were really interested in those decades combining study and training. Part of that was because of the mind/body focus of the conference. There are only two real tools you have to pursue truth, there's logic and scientific method, and direct perception. Each of them has severe limitations because our senses can be so easily fooled, and our mind can fool itself. Wishful thinking and magical thinking and so forth, and the way my martial arts experience and study was brought into those conversations was something I'll never forget.

For example: I have seen auras but for the life of me, I can't tell you if auras are a real thing. I can tell you, with absolute certainty that I have seen them, that I have gleaned information from them that I had no direct, rational way to know, but I can't tell you what they are. It is possible that they may be exactly what spiritualists say they are, or some kind of thermal field at the lower edge of the visible spectrum, or possibly just my mind's way of representing my subconscious perceptions of very subtle aspects of a person's body language and expressions. What I call a complex equivalent. Giving your brain something that you can "see" as a way of making sense of all those little things you don't realize that you are picking up . . . I don't know. In one sense, what they are if they are anything at all matters hugely, and in another sense, it doesn't matter at all, and I'm kind of comfortable with that. I live in the world in between.

COMPROMISES ON SCIENCE AND THE SCIENTIST

SB: Living between those two worlds has always been kind of odd when I work with Larry Niven or Jerry Pournelle or work on a science fiction novel that deals with the hard science concepts in the way that they do. But the hard science concepts that I'm mostly interested in relate to the question of what are we? What does it mean to be human? I just got finished writing a novel called *The Dead List*, and in it there are a series of people being killed by impossible means. I use quantum entanglement as an interesting gimmick to

accomplish this, but that science isn't the point of it. I wasn't thinking "What if quantum entanglement did this?" I was thinking "What if this event was happening and what would it mean and how might people respond to it?" Quantum mechanics was then just, how it was happening. So you can start from either end. The science says this could happen and then find the story like Larry (Niven) and Jerry (Pournelle), or here's something and here's a plausible mechanism to make it happen so I can tell that story, like I do. It's a game you can play either way, but there's still that need to respect the science.

In one story, time travel is a means to tell a story about a woman who was horribly raped and later on in her life developed time travel and waits until serial killers are executed and then goes back and kills them before they can kill their first victims. All of that isn't about justice or saving innocents, it's about building up her courage so she can go back and confront the man who raped her. The methodology I came up with to allow time travel was just pure evil. Even in the metaphor that I was playing with . . . this is so ridiculous that I can't believe I got away with this . . . There are some studies of human development that talk about how when children are less than seven months old, they live in kind of a timeless state, and so this woman is using aborted foetuses to modulate the energies needed for time travel. The point isn't whether or not this can happen. Obviously, this mechanism I invented was pure of bat shit, and for the story, the point was that only a very disturbed woman would think of something like that, but it was still vaguely plausible.

I hope that I don't stretch and distort them (scientists) any more than I stretch and distort any of the other characters. My position is that, when you talk to an emergency room physician, he or she is the last person you want to talk to about theoretical medicine, because they have to save somebody's life this afternoon. And when people talk about doctors concealing cancer cures, that's ridiculous. Doctors die of cancer too. Their families die of cancer, kids die of cancer, friends die of cancer: What kind of monsters do you think they are? What they have is faith in outcomes. They know that a particular approach works, so they keep themselves narrow. That narrowness sometimes might exclude some things that might be useful, but to write them as if they were villains for that, is wrong headed in the extreme. It is kind of exactly the opposite of what they are, because they are focused on what works.

So when I look at a scientist, or write a scientist, my assumption is that this is a person, who is just a normal person, but they've focused themselves in a very specific way so that they have a tremendous amount of knowledge in that specific arena. That knowledge base becomes part of the conceptual lens through which they see the world. So they'll be influenced by that in the same way that a doctor might be influenced by knowing what works and by the oath to first do no harm. That focus is going to influence their personality

and when I write I'm going to try write a human being who sees thing in that particular way.

I can't do it like Greg Benford or Greg Bear would do it, because they live in that world, but I still do it. I know scientists. I've been fascinated by the sciences, I've read countless books on the sciences and about scientists, but I have to start with the question of what the human being is first, and then layer in the scientist on top of that. If I do that, I think it generally turns out okay, but I'll still often run a draft past someone who has some specialized knowledge. If I have to go too deeply into the mental processes of such a person, I can't do that and I recognize that limitation and work with it just like I work with other limitations on my knowledge.

I recently had to write something where I had to delve deeply into the mental processes of career military people and I had never even been in a room where there was nothing but military men, so how would I know what's going on in that room or in those heads? Or what they're like when there's nobody else around? But I know military people and I can ask them and get something workable and build from there. Same with scientists. I think that's my attitude whenever I'm dealing with something where I haven't had a lot of personal experience.

INTERACTIONS WITH SCIENTISTS

SB: What I have to do is have friends that are smarter than me and be able to ask those batshit stupid questions. I have a good, but rough, grasp of the way the universe fits together: big bang, how the first chemicals were formed, first stars, first geological events and planets, evolution of life and formation of societies and so forth and so on. Broad strokes, with a few specific areas where I'm really in there, but I rely on friends and specialists for a lot of the details because I'm much more interested in "what are we?"

My approach to research is that I'll research something until I have an original thought, something I haven't seen anywhere. Then I'll write a paper, or a brief on that thought. And then I will run that paper past an expert. So, in one instance I was looking into cultural anthropology. I did field research and I studied it forever until I came up with the thought that human beings are the only animal that makes and uses fire as a tool. I said, "What if that's true? What are the consequences of that?" Shadows, dances, pushing back the hours of darkness with artificial light. You also are able to drive animals with the fire. Reshape your environment by burning. Fire hardens spears increasing your efficiency as a hunter. So, you get a positive spiral of larger human beings with larger brains and so on. So, I wrote these ideas up and sent it to a friend in the anthropology department at a university and he came

back with what was and wasn't in line with current thought and helped me refine it.

So I work to understand something enough to have an original thought that's informed enough to be able to put the idea in front of an expert.

THE TEACHING MOMENT

SB: My goal in life is to create 1,000 awake, aware, adult writers and teachers. I feel that we are at a place right now where just 1,000 people could change this planet for the better.

Communication is always sharing. Knowledge that allows you to minimize the pain in your life and increase the pleasure is useful knowledge. If it is hooked into the other things you know it is useful knowledge. Otherwise it is trivial. Quite literally by definition, trivial knowledge is disconnected knowledge. So, I think that science fiction writers are teachers. They're often trying to express something that they feel about the universe. I know that there are very specific things I feel about the universe, things I care about, and almost everything I write is about connecting people to those things and those things to things that have meaning to people.

BETWEEN SCIENCE AND SOCIETY

SB: There may or may not be an absolute truth, but the absolute truth cannot be apprehended by the human mind. So everything that we're doing, for all practical purposes is "good enough for army work." You might not be able to absolutely disprove something, but you can come close enough to build buildings and get ships on the moon, even though you can't actually prove that there's a moon up there or that anyone ever went on that ship to the moon, or for that matter you can never prove that anything exists outside of yourself. Going down that pathway of insisting on proof is ultimately futile. It's a lizard that's eating its own tail. You can never gain 100 percent certainty about anything, and yet you still have to make decisions. So, I think that what's important is to grasp or grant the limitations of the scientific method. It's the best tool we've got. It's the best tool we've ever had. So, you can say that we can't quite prove or disprove anything.

Those areas of uncertainty are there and in some ways that's where quacks, charlatans and the metaphysically inclined are playing. To be able to hold in your mind that we cannot have certainty and simultaneously be certain enough to step on a plane and literally put your life in the hands of the science that says it can fly, that's part of the difficulty of living in the modern world.

We don't have the kind of absolute faith that our fathers had, but I think that if we're prepared to embrace the subtlety, it's okay. We don't have to have absolute knowledge.

If I'm sparring in one of the martial arts, there's no way to have absolute knowledge that if I move at this instant, I will be able to hit my opponent. I might slip. I might not be fast enough. They might be playing possum. Anything is possible. People who win are the people who are willing to accept that uncertainty and still move. You have to act. Life belongs to people who can take action. To question the body of knowledge that the sciences have brought is essential. To question the body of spiritual or metaphysical knowledge that people have developed is also essential.

The limitations of science should be understood but they should not stop us from embracing it and recognizing what a miraculous thing it is. If you take a look at magazines from the nineteenth century take a look at the medicinal stuff that was being sold. Radium enemas and shit. Holy god. People complain about the process by which modern medicines get approved, especially mistakes like thalidomide, but they have no frigging idea that people could say anything was medicine in the past. They could give you anything. That's science. The willingness to keep developing means of testing things, refining things including the process of science itself. It is an extension of our own minds. Our tools are extensions of our hands and science is a tool that extends our minds.

Human beings are not much smarter than chimps . . . as individuals. As groups, we are tremendously smarter because we can pass on information from generation to generation. If there is information that is critical for us to have passed on, the sciences touch that. I have what I believe is an absolute and unshakeable sense of the divine and it is anchored in what I know of the physical universe. As far as I'm concerned, the Christ or the Buddha were metaphors that were operating for their cultures. I get what they were saying and it's beautiful. It's wonderful and I feel that the process of "how do you think this through?" "how do you test what you believe or believe you know?" is as important as fire. It is absolutely critical that our children understand this so that they begin to use this. The need to understand how fragile society is and how miraculous this thing we built is.

I've got a friend, Octavia Butler, who said that the thing that scares her the most about humanity is our tendency to be hierarchical. Our tendency to place ourselves higher on the hierarchy than others. I was never interested in politics. Politics seems to be the politics of compromise. How do you get large groups of people to be able to move in the same direction? I feel that politicians are doing something miraculous to get millions of people, hundreds of millions of people to all, more or less agree on broad, overall conceptualizations of what they are supposed to be doing.

I can't do that. I'm not flexible enough to do that. It would break me. I would lose my sense of ethics if I did that. I have real respect for people who can navigate through that.

I didn't involve myself in any of that until the Obama presidency. Then I thought, let me observe the American political scene for as long as he's in office. Let me see if he can get re-elected, let me just watch. During that time my impressions about politics were reinforced, but I also started asking questions about why do people lie so much? It's so obvious that people are lying and so obvious that people are shutting out information, and how does this relate to human perceptual apparatus? Why are there such differences in belief about global warming or evolution? Why is that politicized. I would have thought that if there were about half on each side of something like global warming then yeah, you debated it, but no. Evidence is overwhelming, and the conversation is people yelling past each other, thinking different opinions about.

I performed some experiments right after the Charleston shooting. I decided to involve myself, to take the philosophical methods of inquiry that I had used to pursue my individual growth and ask, can this be applied to the social. One of the things that I determined was that there were problems that people cannot see answers for, and if they do not have some form of faith, they can crumble. They can feel very, very pessimistic. But that goes back to my thought that all of us are smarter as a group. The group mind of the human race, if it is faced with a challenge, will come up with an answer. It has so far. 250,000 years we've been doing pretty good. I'm not egotistical enough to think that my generation is the one that finally runs into a wall we can't get around. I don't buy that.

The methods of doing this . . . I was able to test this on Facebook. You have to exclude people who aren't interested in being polite and . . . there's the oleaginous courtesy that one sees in politics. "The distinguished gentleman from Kentucky" who is actually someone the speaker hates severely as a person, but as a representative of his people, he has my respect. I started seeing how important that is, because without it you get the social equivalent of a seizure, the two sides of your brain can't talk.

WHAT SHOULD I HAVE ASKED?

SB: How might one express your model in a way that a school child will see that embracing it will bring more pleasure than pain into his life and help him to navigate the adult world? If you can understand what it is you're trying to say so simply that you can communicate it like that to a child, you'll be able to accomplish what it is you are trying to accomplish.

Chapter 4

Greg Bear

A lot of these books are, in a sense, trying to recreate the evangelical moment where you have an epiphany. In science fiction it's often a technological epiphany. It's a religious parable, but written in technological terms.

—Greg Bear

While I've read just about everything that Greg Bear had written, I had almost no idea who he was as a person prior to sitting down with him for the interview. The only communication I had ever received from him was his response to the university human subjects committee-approved form letter requesting an interview and a text confirming the time and location of the interview.

Greg is known for hard science fiction novels that tackle stories about hard science topics ranging from evolution, such as *Darwin's Radio* (Bear 2003) to the astrophysics in *The Forge of God* (Bear 2001).

ORIGIN STORY

GB: I would say that watching a plane crash in the Philippines, from the perspective of being a seven-year-old kid, standing just outside the runway and watching them foam down the wreckage of a sabre jet was that first moment. I thought “whoa” and suddenly knew that planes could crash. As a military brat I saw a lot of that sort of thing. That was technology more than science but there's a lot of informative moments that come down to that failure of the technology. It's a cautionary tale about the world around you and what's going on and how powerful nature or the universe is. Then you meet pilots,

you meet scientists later on and work with them and that's there, in the background.

As far as the first real science moment, that's tough to answer because I was always embedded in a world full of technology that was moving me around the world when I was a kid.

In terms of giving me a scientific principle, science fiction wasn't so much a factor. I was really into reading comic books and many of those stories would infuse their way into my brain. Some of those were more or less scientifically interesting. Scary movies, like *20 Million Miles to Earth* (Juran 1957), which I saw, with a monster from Venus, with a monster that ate sulfur and grew twice in size every single day. Well, there's a hypothesis that you could probably test. So what's that, square cube law, what's going on there? And as a kid, I started thinking in terms of how does that make sense or not? Then you start laying down the idea that you can figure that out. What's Godzilla like? Where does the radioactive breath come from? And then, where did dinosaurs come from? What did they look like? What were they doing? Were they really as nasty as we think they were? All these questions occur to kids as they're reading books and they occurred to me.

Some of it kind of begins with the fairy tale approach of science fiction movies and comic books. You're getting a lot of the ideas in rough form and that's kind of the fibre that's going to be filling in your scientific knowledge later on.

COMPROMISES ON SCIENCE

DVB: Greg's answer to the question regarding compromises to science or the nature of the scientist that have been made for story telling is a simple, "No." He emphasizes his extensive research and a commitment to credible, plausible science even when the implications seem incredible. This morphs into a commentary on his interactions with scientists.

GB: Since I was aware of the technical trades, meteorology and things like that at an early stage, and I did research and tried to learn as much as I could about these things, generally speaking, even my early stories, the people were doing stuff that was credible. Or at least it wasn't incredible.

All along, I'm improving on using the language that scientists actually use, which is very important. Scientists have a language that is very specific to their particular science and that's essential. It's like watching sports, with the dialogue. And also, because scientists communicate more quickly with those precise terms then you can't really understand what they're saying unless you know that language. So, I had to learn that language to bring my characters to

life, to make them make sense. A lot of science fiction is read by scientists. A lot of science fiction is purchased by editors who know science very very well. So, I was always trying to impress that particular crowd. That meant I just had to get better and better at capturing that moment in that language, and the ideas that were behind it were interesting in and of themselves.

I wanted to know more about science. I gave up on being a scientist when I flunked calculus, but I didn't stop doing research. Through that I found out that my expertise was in looking at large-scale processes and winnowing out trends and possibilities that scientists were ignoring but none the less seemed to me were contradicting what they were saying about the metaphysics of what they were doing, by which I mean the large-scale theories. One of the earliest being evolution.

When I read up on what was being said about mutations and evolution, I suddenly realized that there seemed to be a wide range of other possibilities here that could explain these mutations, not just randomness. Directed mutation caused by the needs of the organism which is totally verboten in the days I was studying this. This was considered totally outside the reach. In fact, heretical. And that amazed me because: A.¹ I wasn't getting my doctorate so I didn't need to kowtow to the orthodoxy, so I could go off and do my own research. And along the way, I improved my understanding of why it won't work and why it perhaps could work. And that was, in a sense, independent research. So I was acting like a visiting scholar coming in to a discipline and learning more and more until finally I had the expertise to make really interesting judgements about what the scientists themselves were saying.

It was interesting to talk about this, with scientists, in their own language and sort of feed the ideas back to them and say, "now you know this and you know this but did you know this?" which they did not. Or "this is one data point that kind of contradicts all these other data points you've been seeing in the textbooks for generations." And "this particular theory is not really strictly Darwin because Darwin never said that." So that theory is an expansion of Darwinism into an orthodoxy that becomes less and less credible the more specific it gets.

And in that way, I could be extremely irritating if they paid any attention to me, but they did not, and that taught me something. They were so totally fixed on being absolutely certain that the theory of evolution that they understood was correct, that when I came in and added things that were not part of that understanding, they couldn't see them. This wasn't creationism or something like that. They were alternative scientific principles, which were being presented by the evidence and were either being ignored or explained away, in ways that didn't make sense logically.

That was cool. That was great and I had a ball doing that because: A.² It wasn't hurting my career and a lot of scientists would find that their careers

would be severely hurt if they expressed principles different from what their graduate advisors were saying. I realized, “Oh my god there’s an orthodoxy in science.” How many stories can I pull out of that? How many cautionary tales can we pass along to young people about how do you really criticize science? It was a long term process but along the way, because of my radical lack of need to be part of the scientific process at the deepest level, I didn’t get my income from them and I wasn’t getting my PhD or anything, I could read a lot of stuff and draw inferences that were not really easy for scientists to do.

The word heresy fits, but not actually heresy at all, but it was false heresy. You said this and that is wrong, and we know it is wrong but you don’t actually know it is wrong and later on it is proven to be correct.

And I find so many instances of that, where they tried to shut down scientific careers. Like Barbra McClintock who published her papers on jumping genes. She was not always that clear a science writer, but her ideas were very good. Her research was very good, and she proved that jumping genes existed. She was attacked from all sides. A:³ because it’s a patriarchal community and she had to really fight really harder than she should have, but eventually, she prevails.

What happened to all the people who opposed her? They are mostly forgotten now. So if you are wrong, you lose the game and you fall out of the history books. And that’s sad, so I could tongue in cheek say that I’m doing this to try to protect scientists from falling out of the history books.

I also noticed that a lot of these challengers who were attacked were female, and that taught me a lot about scientists. And listening to other scientists talk I realized that there was kind of a patriarchal priesthood of older scientists. I forget what the exact quote was but one scientist says, “You know, the last scientist who holds that position has to die, before it stops being dogma.”

Some of the biologists actually use the term dogma to describe the pattern of expressing from DNA to RNA to amino acids to proteins. But I said, “That’s just a one-way process and we now know that there are instances where that doesn’t work.”

In the 80s, when I was becoming aware of that, I said to myself, “It’s got to write back on itself at some point,” and that was heretical, but not for people who had already discovered it. The other thing I suddenly realized was, “wait a minute, I’m discovering this but I’m not the first.” The scientists are doing the heavy lifting. They’re taking the body blows and they’re losing their careers, and all I’m doing is gad flying around, picking and choosing what I want to write about. It is important to me to honour those scientists. Honour the people who fought the good fight and had a lot to lose because of that.

In some sciences they embrace that. In physics it’s common to lay out to graduate students the challenge to prove Einstein wrong. In evolutionary theory they don’t do that. Prove Darwin wrong and it’s a sure way to get bounced out.

The other thing is that the older scientists really do hold an irrational power in the community. When they are politically trying to kill you because they regard you as heretical, it's also because their theories are being threatened. The theories that they posited when they were young and have been using in their textbooks and research has solidified around them. They feel like they cannot go back and reverse all that. Sometimes scientists are their own worst enemies because the young people just get irritated after a while and they go out and do more research and throw you aside. Then the younger guys are in charge of the department, and the cycle repeats.

So science is a human process, which is something that scientists don't really want to talk about because they want political power inside the science. They want the power to state their needs, get paid to do those research experiments and to prove those things. And at the same time, they want the ability to tell other people that there is no god. Your religious beliefs are irrational and basically my scientific culture is correct and yours is wrong, which is a sure-fire way to get killed politically. So you can't teach scientists how to protect their culture when their culture is not politically sensitive, or even humanly sensitive.

THE TEACHING MOMENT

GB: People believe in religion, you believe in science, where's the common ground? Surprisingly, the Catholic Church, over the years has actually done a pretty good job of bringing the common ground together. Richard Dawkins does not. "Your god sucks" is not going to make a lot of friends.

So I always thought it would be interesting to just go into a church and explain things on their terms. And they started doing that in the evolutionary debate about fifteen years ago. Some of the evolutionary biologists would come along and say, "Look, we cannot prove or disprove the existence of god, and we cannot eliminate god from the equation, so god may do all of this stuff we're talking about. What we're trying to do is understand as much of that as we can in scientific terms rather than religious terms. Maybe it is the finger of god. If it is, then we're learning how the finger of god writes and works. That might be arrogant, but maybe god has fun letting us play in his fields."

That can be a persuasive argument to some religious people. Obviously not all, there are plenty of them who don't want you to do any of this, but you get more people on your side, particularly young people, and you get into the debate on a totally different level and a totally different angle. You're not trying to shatter their belief system. You're trying to expand their knowledge, which is what old-fashioned science used to do.

Galileo was going up against a religious orthodoxy, but he knew how to play along. Until he encountered something that was just too nasty to overcome. And then they die, and he lives on.

The other thing you could throw out there is that maybe these things simply are puzzles. Maybe god is discovering himself through your activity and is taking great joy in you expanding his range. Cool idea. Theologically fascinating. Share it and let them have fun with that and then scientists and religious people could get together and talk about how what your discovering is the self-discovery of god. I'm not sure a lot of evangelical communities would embrace that, but it's kind of fun. A lot of young people would like it. And it might inspire more young people to get into science.

BETWEEN SCIENCE AND SOCIETY

GB: Science fiction comes at the religious angle from another perspective. The mystical vision of science fiction is very clear in such things as Arthur C. Clarke's books or Olaf Stapleton, even some H. G. Wells. A lot of these books are, in a sense, trying to recreate the evangelical moment where you have an epiphany. In science fiction it's often a technological epiphany. "oh my god that starship is a million miles wide and that's awesome." And what's inside of it? Why, the origin of the human race is what's inside of it. It's a religious parable, but written in technological terms.

One of my favourite examples is *2001: A Space Odyssey* (Kubrick and Clarke 2001). Which has directed evolution. Pure heresy, both scientific and religious. And yet, the scientists don't bitch about it. They don't complain because A:⁴ it's aliens doing it, it's not god. It's highly advanced aliens who some scientists can imagine could come in isolated non-material forms manipulating the universe. Well that's cool, but it's also making these apes something they weren't through touching them, through directly touching their genes. In the novel it's touching their genes. That's scientific heresy, but science fiction gets away with it.

And the other way round . . . finger of god. All these god-like aliens are just a replacement for god. You don't understand them. You don't claim to understand them, but scientists don't feel offended by their existence either. How perverse is that?

So science fiction writers kind of create a safe space in between . . . maybe.

WHAT SHOULD I HAVE ASKED?

GB: Well the two cultures, which I have often called the humanities versus the scientists, though those are both academic cultures. What you have here is

the public and its perceptions have kind of been ignored by the scientific community because of the examples of religious persecution and everything else. Galileo to Darwin . . . who probably ended up being kind an atheist because of the things that were being said about him in the press and was reluctant to express his ideas in his books until it just reached the point where he had to do so because he was in competition with other, younger scientists. Wallace for example, was about to sweep him from his lifetime study. So all of these things that you have to be more polite and more understanding of the needs of the audience you want to persuade. You cannot just steamroll.

If you're a political conservative who has roots in the religious community, how much of what you are doing is feeding them cocaine that isn't going to help them in their spiritual growth?

How much of what science does is feeding scientists the assurance that there's never going to be a change in their science. That's BS. There's always going to be change in science. You cannot fix science to the wall.

Last example is the whole Clovis points issue. American Indians came to America 10,000 years ago. That's set in stone. Clovis points prove it, only, it's not. We found these other points that are 12,000 years old and they're not Clovis. Clovis points may come from an older and broader tradition. Clovis point guys come back with some variation of that doesn't prove me wrong, and now they're all on the sidelines. Then they finally conceded. Now we have good honest responses of "well I guess we were wrong." But for how many decades did they rule anthropology?

I think I put this in *Darwin's Radio* (Bear 2003), or *Darwin's Children* (Bear 2004), but there's some genetic evidence that hints that you may have had migrations of Australian groups up from South America and that Asian groups coming down and meeting them somewhere around Mexico and competing.

And in *Darwin's Children* I have the Neanderthals reappearing, and then we had Homo Florensiensis appear in Indonesia and they were 18,000 years old and maybe Homo Erectus, but they were three feet tall. So if I believe it's some kind of dialogue with a self-discovering god it's like god is saying, "See you and raise you one. You never thought Hobbits would be found in scientific terms, did you?" And so many scientists were blown away and they still don't accept it. They say "Oh! They're mutants."

So science is continually surprising. The one thing a scientist is supposed to do is be critically adept at finding the actual answer. So they can't just accept something right off the bat, and the back and forth is very healthy. One scientist saying "that's bullshit, I don't believe that at all" and here's my evidence. And the argument eventually winnows down. That's good. It's when something gets fixed in place based upon the needs of an individual scientist or small scientific community that science starts to bind up and skid and that's not good.

So as a science fiction writer what I love to be able to do is to read all the papers and then put them together and go to the scientists and say “did you guys read this paper? Because it looks pretty solid to me and it contradicts a lot of what we think.” That is so cool. They don’t often have time to read widely, but when I get together with the virologists or bacteriologists or whatever, their stuff contradicts evolutionary theory so much . . . and in botany as well. A lot of stuff in botany contradicts the standard view of evolutionary biology.

That’s just great fun. Getting together with biologists and such is one of the most pleasant things to do because we talk shop. They know more about some of these things, but I get to bring in things they would otherwise miss.

NOTES

1. Greg never seems to get to B.
2. Again, don’t hold your breath waiting for B.
3. I really thought we were going to see a B with this one.
4. Not even sure what a B could have been on this one.

Chapter 5

Gregory Benford

To me science and science fiction have always been intertwined.

—Gregory Benford

Prior to our interview, I had met Greg at a handful of science fiction conventions, and we had had a few casual conversations, primarily around quirks of the latest cosmological theories and technical aspects of issues related to astrophysics. While some might consider those to be some very odd topics for casual conversation, if you add a relaxed and friendly demeanor, the fact that Greg considers them topics of casual conversation provides a tidy summary of the man. Despite those earlier conversations, it would be incorrect to say that we were even acquaintances. I knew very little about him and, with the thousands of people that Greg meets at conventions, he would have been very hard-pressed to even recall that we had previously conversed.

While several of the authors interviewed have advanced degrees and many have worked as researching scientists, Greg is clearly the most accomplished scientist of the group. Despite being one of the clear masters of the genre, he is an even more accomplished astrophysicist. Among his most notable novels are *Timescape* (Benford 1980), *In the Ocean of Night* (Benford 1977), and *The Martian Race* (Benford 1999).

ORIGIN STORY

GB: To me, science and science fiction have always been intertwined because I began reading science fiction when I was eight or nine and then moved into the Heinlein juvenile series and beyond into the works of the major figures in the science fiction of the 1940s and 50s. I loved the scientific aspect of it.

I even studied nuclear physics when I was a boy in occupied Japan. My dad was an army officer and after fighting in the Second World War we lived in occupied Japan for three years and then Germany for three years. The children that you'd call army brats, are often readers because you're living in a foreign culture and you can't speak the language and you are confined to bases. There are plenty of times where it was not really safe to go off the base. So, we read a great deal.

I'm also . . . and this is an important part of the origin story, the whole story really. I'm an identical twin. In fact, the closest form, mirror twins, and my brother and I both supported each other in our interests. We both have PhDs in physics from U.C. San Diego for example, even supporting each other in grad school. We also were big science fiction fans and starting at the age of thirteen we started publishing a science fiction fanzine while we were living in occupied Germany. So, science and science fiction were always intertwined in odd ways.

The single event that wedded them all together, having read a great deal of science fiction and having published dozens of issues of the fanzine, and therefore having written perhaps half a million really lousy words already, occurred in my junior year of high school, after we moved to Dallas, Texas. It happened upon *Atoms in the Family* (Fermi 1954). In that, I saw how Enrico Fermi had worked himself up through school and into graduate work, and I had a good understanding of the nuclear physics involved so in that I saw this whole career laid out. My brother had the same reaction. We both recognized the career that we wanted.

My brother never actually became a professor. He became a research physicist in industry, but he and I have coauthored dozens of papers together and have had a close collaboration all the time. It was those entwined lives that gave me part of connection between science and science fiction because in a way, both our lives and science fiction both seemed to be on a rise. The sudden rise of science in the public eye and in its general reach and power, and science fiction beginning to make a significant impact on the culture all seemed to say that this was the way to go.

So, we had a further great advantage, though we didn't know it at the time. We were on the *USS America* on the way back from three years in Germany, when the ship's newspaper had a short little two-paragraph piece that said, "The Soviets Launched a Satellite around the Earth." I knew exactly what it meant but I was so frustrated because I couldn't get any more information until we got to New York.

Once we did get more information there was enough detail so I could sit down and do the orbital calculations and determine that it was going to come down from the atmospheric friction. Point is, that launch also set off countless opportunities for people like my brother and me. When we went returned to

go to high school, suddenly there was a college level physics course and a college level calculus course, which hadn't been in the curriculum the year before. And on top of that, that was the first year that what would become the SAT was offered and both my brother and I got perfect scores on both sections of the test.

I had already been a smart ass, but in that moment, I realized that I might actually be smart.

I've always liked thinking about the future. The metaphor of space travel was and still is the central one for science fiction, and science seemed to be the way to make that world happen. I never really considered becoming a full-time science fiction writer. I had just always thought it would be a fun hobby. I enjoy writing and I got interested in it again in the middle of graduate school. In 1964 I picked up *Fantasy and Science Fiction* off the newsstand and it said here's a poem that includes a unicorn and a UNIVAC and here's a contest for a thousand-word story that contains both of them.

I sat through a boring class on statistical mechanics in which I'd already learned everything that was being lectured on, and mulled it over and I suddenly had the idea for a story. Went home that night, typed it up, polished the next day and sent it in to the magazine. I won the contest and it was published in 1965. So, I took it up again and I started writing hard science fiction, which means scrupulous, scientifically realist science fiction, that at the very least, does not contravene the laws of the universe and has some respect for how those laws are found.

So most of my work has been from the point of view of a scientist, confronted with a discovery or situation, and it looks at how a scientist thinks about it and deals with it. I don't do it in a philosophical way, I just used my experience as a graduate student and then as a post-doc with Edward Teller, which really was a boost for my career and from which I learned a lot about not just nuclear physics, but also the Second World War. Teller was a fantastic storyteller. Then I went to Livermore and four years after I got my doctorate I was offered a faculty position at U.C. Irvine, which I decided to take because I could move back to southern California and live in a beach town and go back to surfing, which was actually the most important thing I'd learned in graduate school in San Diego.

All the way through that I was accumulating experience, including how to design tactical nuclear weapons, which is actually a fascinating technical puzzle. How do you take something with the punch of a Hiroshima bomb and package it so you can put it in a cruise missile? Nuclear fusion machines for electrical power and other things. I did a lot of diverse things and I started to incorporate that.

My best-known novel, *TimeScape* (Benford 1980), is actually a thinly veiled autobiography. Half of the narrative occurs in San Diego, in 1962

and 63 from the point of view of a young assistant professor and indeed, in that part, two twins are irritating students who take up too much of his time. The other half is set in Cambridge England, in the future, in the middle of an ecological catastrophe that has descended on the world, where they send a message back in time. And that is based on my sabbatical leave to Cambridge in the 70s. It turns out that I have a knack for recollecting little details. So, I didn't even have to go back and look things up. So that was my first example of writing an entire novel that is just about a scientist at work.

It won several awards and it kind of solidified my view of what science fiction could do. There are a lot of other science fiction writers, but I had a unique experience. The chief problem I think full-time writers have is that they spend their days alone in a room, looking at a screen. So where's your material? It's not any accident that John Updyke's novels deal obsessively with suburban adultery. Write from what you know.

So that's how I went along. I always put my scientific career first. After all, when *TimeScape* was published I had been a professor at UCI for nine years. However, it was also true that my wife had polycystic kidney disease and she needed a good deal of care. I saw writing science fiction as a way to get the extra money we needed to pay for that care. So it was very useful that way too.

COMPROMISES ON SCIENCE

GB: The most common compromise is to compress time for the narrative. Whereas real science has lots of dead time where stuff doesn't work and experiments take a long time, and you don't get the funding the first time you ask for it, it all takes far more time than you can put in a story. I actually use that as a light motif in the background, particularly in *TimeScape*. Funding is always the big issue. Therefore, I narratively skip steps that you really would have to take as an academic. You'd be held up by the bureaucracy and then have to go to the chairman and the dean and who knows who else for a signature before you send out a funding request. I tend to compress that. In fact, one time I did it by having a character walk the paperwork around the campus to get all the signatures and push the paperwork through each stage of the process. Because I actually did that once and got something through the whole university process like that, in one day, where it would normally take weeks.

It's also true that I try to use the real way that rivalries work in academia so that pitched battles are carried out, typically on the backs of something else. Someone came up to me years ago and said, I can't imagine you had the balls to have an entire chapter in *TimeScape* which is just the thesis examination of a student and professors are plainly fighting with each other about this

experiment, through the student. They're asking him embarrassing questions, which then the professor has to step in and help him answer it. So it really isn't about the student. It's really about the fight between the professors. I've seen exactly that happen, but it's an insight you don't get unless you've actually been inside the academic world for a while.

INTERACTIONS WITH SCIENTISTS

GB: All the way through my career I've known many prominent scientists, many Nobel Prize winners, and, tellingly, people who didn't like Fred Hoyle. Because the first talk I ever attended in graduate school was him giving a talk about an alternative theory of General Relativity. He prefaced it by saying that he was exploring this in order to keep the options open about our ideas about cosmology. And of course, he is famous for being a proponent of the steady state theory, which was ultimately proved wrong. But the fact that he had a chip on his shoulder was clear from the first sentence of the colloquium really struck me. And that sense of the moment was not impeded by the fact that the colloquium was in a gorgeous room with a curved green blackboard and a glass wall where you could look out at the beach at La Jolla with the waves breaking on it. I thought "I've gone about as high as you can go in the scientific community, because everything is wonderful," and there was still that chip on his shoulder.

I've often tried to convey that sensation of being almost reverent before the holy sites of the scientific enterprise. That was one of the reasons I took a sabbatical in Cambridge and why I go back there often. There I'm at the place where so many great discoveries have been made over the centuries, but also I once wrote a whole essay about a dinner party that Martin Rhys hosted. I thought we were just going to go to High Table at Trinity, but when my wife and I arrived, we were ushered into a private dining room, and there was Steven Hawking and his wife, and (Paul) Dirac and his wife and that was the dinner party. I wrote a whole essay about that dinner party because for me, that was an incredible thing, and it's not the sort of thing that many people get to experience and I wanted to share that, particularly with others who love science in the way that we do. That . . . reality is something I want to bring to my novels. I have disguised versions of countless other scientists scattered everywhere in my novels, and one of the things that my closer colleagues do is try to guess who the characters are.

So I've always stolen from life to get that kind of essence in my novels. Scientists are as quirky and as individualistic and as eccentric as anyone, maybe even a bit more than most, and it's important that people see them as artists. Scientists also tend to be more athletic, more cosmopolitan, and

they're also more careful about the ordinary business of life than most people would imagine. They tend to make few mistakes; fewer mistakes with investments or paying bills or other aspects of everyday life than people think. They're just better organized than most. And they're obsessive workaholics.

There's this famous old joke. There's this physicist and he spends all of every day at the lab and one day he's going to go home early and surprise his wife but he meets a gorgeous woman who propositions him. He goes to her hotel and spends hours and hours with her. Finally, he drives home, and he feels so guilty that he decides he has to tell his wife. So, he comes in the door and he says, "This afternoon I met this woman as I was leaving the lab . . .", and she says, "Don't give me that crap, I know you would never leave the lab that early in the day."

THE TEACHING MOMENT

GB: Well in the science fiction context that could be a signifier for "here comes an expository lump." But the teaching moment might be best considered as when you find an opportunity to illustrate something or show scientists at work by their actions. So in a conversation, or in an argument, or in passages I've written where it's about what it feels like to do a mathematical calculation and blunder your way through until you have a sudden moment where it works and you have a revelation.

I had had that happen to me many times over the years. It's great to do in a narrative if you can, without getting too boring, and there's the trick. I learned a bunch of the techniques for doing that by the narrative methods that John Updyke uses. He's great at interior monologues.

Back to the teaching moment, I like the sweet spot of finding out how to show scientists at work and at the same time illustrate the science they're working on. That has to be done mostly through dialogue, through a little bit of narrative and I like that kind of thing.

There was a fantastic couple of pages in the biography of Schrödinger (Moore 1992) in which they reproduced the notebook from when, over a weekend, he was off with his mistress in the mountains, he was trying to figure out what Max Born had said to him about wave phenomena, which is obviously what would be on a physicist's mind when he's off on a vacation with his mistress. So what's the wave equation? So he writes down this and that and spends a moment trying to get the units right and there's the Schrödinger equation and he realizes that it's the first derivative in time but the second in space and that's the energy. All of this is almost a units of measurement argument because he wants to get the diffusive phenomena out of it and not just wave phenomena, blah, blah, blah. Of course, when he published

he had this derivation, but the way he invented it was just that simple. And then a few pages on he works out the particle in a box problem, and then a few pages later he works out the hydrogen atom and then he realizes he's got something and goes back and does the proof. To me it was a brilliant example and a brilliant editorial choice to actually show the notebook because that's actually how you really do science.

BETWEEN SCIENCE AND SOCIETY

GB: I think that writers, particularly science fiction writers, are uniquely positioned to be the intermediary between scientists and society and that's one of the reasons that science fiction has become such an enormously popular genre. There's an anxiety, I think largely unexpressed, among the public about the enormous importance of science and technology. On the other hand, there's the fact that the actual work of scientists is rather congested and difficult to translate work of science. There's a tension between those things. The fact that academics and scientists have what really are ridiculous levels of oversight over them comes from the idea that bureaucrats have that you have to really check-up to make sure these nefarious scientists are not just wasting their time and your money on nothing. Any scientist knows that's a pretty foolish thing to think, but that is kind of a symptom of the tension between these parts of society.

Science was not the traditional source of power in the world. 200 years ago, nobody would have imagined that the scientists would be the big driver in human society. Business magnates maybe, or the church, or political leaders, but not scientists. So society is not used to seeing scientists driving things, almost from behind the curtain. Don't pay any attention to the wizard behind the curtain. So a science fiction writer stands between these two because unlike mainstream writers, the science fiction writer can actually write about science, in the fiction context, with some understanding of what's going on. That's the reason many mainstream writers are writing science fiction . . . poorly.

I had the odd experience of being on a book signing tour in the 1990s and the same agency was handling me and P. D. James. We ended up having dinner together a couple of times and she was thinking about writing a science fiction story, which became *The Children of Men* (James 2010), and we talked for hours about how you create a convincing future. I said that you had to have enough difference to make a difference, but you need something out of place but not really out of place in order to carry the story forward. For her, that became the pregnant woman in a world where the human race had stopped reproducing. That gave her the thing she needed to talk about the science and communicate those elements to the reader.

I think the tension between science and the public is best illuminated by having narratives about how scientists work so you can see how these strange people function. Artists have the same trouble, but they aren't in that same position of power that scientists are. But then we also have lots of films about artists in that situation, but we don't have the same for scientists. We have that film about Steven Hawking, which I thought was exemplary. It was so well done, and I knew Steven as he was in that era and that actor got it just right. But . . . unlike the movies about artists and their art, there was no science in that movie. We need more movies like that, but we also need the science in there. The movie about Alan Turing was dreadful. It's awful in the sense that it completely fabricates falsehoods left and right. The villains in the movies are actually his allies in real life and it was not possible to blackmail him for being gay because everybody around him knew he was gay already. He used to make jokes about it.

WHAT SHOULD I HAVE ASKED?

GB: Maybe why does science need science fiction, maybe? Every profession likes to see itself portrayed in fiction, but in the case of science it's crucial. Science is actually a positive actor in history. So it really needs to have a better portrait of itself available to the public and that is one thing that science fiction writers can do. The public really doesn't understand how we think. What we take as proof and what is fantastical. So the visual media could do more about engaging the positives of what science is without wallowing in conspiracy theories and sometimes ridiculous depictions of the whole enterprise, but science needs science fiction, particularly hard science fiction to better show how it is a positive force.

Chapter 6

Ben Bova

If you think of human history as a vast migration of billions of people across the landscape of time, then science fiction writers are the scouts. We're the ones that go on up ahead and bring back reports like: Don't go there it's a big swamp, try going this way instead, this is a good place. Unfortunately most of our leaders don't read science fiction and we keep ending up in swamps.

—Ben Bova

Ben was something of a mystery for me as we started the interview. I knew him from his writing, particularly his Grand Tour of the solar system series of novels, where he meticulously explores the far future presence of humanity as they live on or are in the process of colonizing every significant planetary body in the solar system. I had, however, never met him, nor had I ever even heard him speak at a convention. Our phone interview was arranged with a few extremely brief emails, and his clear but brief responses to the bureaucratic preliminaries that are required before conducting a research interview offered no hint whatsoever about the person who would respond to the first question.

His responses were direct, and more focused than many of the other respondents. I later realized the implications of his degree in journalism and understood that what he was offering in the interview was what a journalist would want, rather than the more expansive responses sought in a research interview. Still the conversation was far more relaxed and lighthearted than it might appear in a first reading of his comments. If you imagine persistent hints of a droll sense of humor as you read, you will probably get a better feel for the tenor of the conversation. His Grand Tour series starts with *Mars* (Bova 1992).

ORIGIN STORY

BB: That's very easy, I was eleven years old, I was in junior high school in south Philadelphia and they took us on a mandatory class trip to the science museum to the Franklin Institute in Philadelphia. Almost everything is named after Benjamin Franklin or William Penn. So they bring us to the planetarium, the planetarium was named after this man named Fels. He made a fortune making Fels-Naptha soap, the harsh brown soap that took off dirt, skin, nerves, right down to the bone . . . and then he donated this money to build a planetarium. Well we didn't know what a planetarium was, we were a bunch of apprentice thieves from south Philadelphia, and they bring us into this big strange round dome and in the middle is something that looks like this black robot ant; it turns out that was the planetarium projector. They sit us down, they turn off all the lights and you literally could not see your hand in front of your face. I tried it. It was utterly dark and then they suddenly turned on the stars. And then that turned me on and I was hopelessly hooked.

I began to learn as much as I could about astronomy. Actually the head of the Fels planetarium Dr. I. M. Levid became sort of a mentor for me. I learned astronomy from him and he learned football from me, we watched football together on one of the few TV sets in Philadelphia at that time. So he introduced me to astronomy texts and in those books I found there were people who dreamed of going to the moon, of building rockets and going to the moon. So I became interested in rocketry and astronautics and then I learned that there were stories about what it would be like to do that and stories about the future and that's how I found science fiction. I was just hopelessly hooked and I've been that way ever since.

I'll tell you one story that does stand out in my mind, it was by Isaac Asimov and it was called *The Strange Little Boy* or something like that (*The Ugly Little Boy* (Asimov 1958)). It was about a Neanderthal child brought to our time by a time machine and a female doctor who has to more or less raise it. To this day I think it's Isaac's best short story.

As far as education, I have a doctorate in education from California Coast University, a masters from the State University of New York in Albany, and many, many years earlier I got a bachelor's degree in journalism at Temple University, which is a concrete campus, a workingman's school in Philadelphia.

I was born and raised in South Philadelphia. It was tough . . . but good people.

COMPROMISES ON SCIENCE

BB: No, I try to tell the story as honestly as I can. I have spent a good deal of my adult life working with scientists and I think that the way they're

portrayed in most forms of fiction especially in movies is just revolting. The scientists I write about are drawn from real life. You know young writers are always told “write about what you know” I tell them write about who you know. Draw your characters from life, make them as lifelike as possible, give them the problems that they really have, show people how they go about trying to solve these problems, that’s what makes a story.

INTERACTIONS WITH SCIENTISTS

BB: Well I graduated from Temple University with a degree in journalism and in fact a few months before I graduated. I got a job on a suburban Philadelphia newspaper, a weekly. So I became a newspaper reporter which was a great experience and wonderful fun. Didn’t pay much though. But in the midst of all that I saw an ad in one of the Philadelphia daily newspapers “the martin aircraft company is looking for engineers for project vanguard” which was the U.S. government’s attempt to put a satellite in orbit during the international geophysical year. Now this would’ve been like 1955 or so. I went to the hotel where they were interviewing engineers and the first question they asked me is “what kind of an engineer are you” and I said “I’m not an engineer, I’m a writer, but I understand the engineer’s language, and I can write it so that ordinary people can understand it. This project is all about the first artificial satellite of earth and it is going to attract a lot of attention from a lot of different kinds of people. So you’re going to need somebody like me” and they bought it!

They hired me! I didn’t have to tell them I would scrub the floors and wash the windows, I wanted to be part of that program so bad. Of course the Russians got into orbit before we could but it was a good experience for me and the beginning of many, many years of working with scientists and engineers.

TEACHING MOMENT

BB: No, I don’t write to teach, I write to illuminate. I write to show people things as they are or as they may be. Teaching to me implies something much more formal and frankly unpleasant.

Yes, yes, I know I have a PhD in Education, but it’s not in teaching, it’s in education. I went for a doctorate in education to try to find out what’s wrong with our school systems, and unfortunately, I did. That’s another long, long story. It’s the bureaucracy of the system.

The important thing is teaching yourself, it’s important for you to learn. Writers have to continually learn new things, meet new people, expose

themselves to new ideas. You know I've always thought of science fiction writers as the scouts who precede the main body of the human race. If you think of human history as a vast migration of billions of people across the landscape of time, then science fiction writers are the ones that go on up ahead and bring back reports like: Don't go there it's a big swamp, try going this way instead, this is a good place. Unfortunately, most of our leaders don't read science fiction and we keep ending up in swamps.

BETWEEN SCIENCE AND SOCIETY

BB: I think, not just me, but science fiction writers in general, whether they know it or not, whether they like it or not, are writing all the different kinds of possible futures they can imagine and some of them actually come true. It's what Fred Pohl called the broken clock analogy. You know that a broken clock is right twice a day. So you know that if you write enough stories you're bound to hit a few of them, but all the stories that are written show possible realities, potential realities. It gives the readers a chance to look at things that might be and maybe make some choices about where you want to go and build the future. I always have to laugh when I see a news story about some new developments and new technology where the story begins with "it sounds like science fiction, but it's true!" Hell, automobiles were science fiction one time too. H. G. Wells wrote science fiction about airplanes and nuclear bombs, now they're all part of the landscape.

QUESTION I SHOULD'VE ASKED

BB: Why don't we move forward? Why don't we use our science and our technology more beneficially? And I think it's because not enough people understand what science can do. If science fiction has one benefit to society, I would hope that it is to show the people who read our stories that scientists are people too. The same loves and hates and they're too damn smart to want to rule the world, but they provide the work that has made us wealthier, healthier, and better people.

Chapter 7

David Brin

We try to expose the potential failure modes of human civilization and potential opportunities.

—David Brin

Prior to the interview, I had met David on a few different occasions, briefly conversed with him a few times, and I had frequently seen him participate in events at conventions. However, as is often the case given the sheer number of people these writers interact with at conventions and in other professional forums, it would be incorrect to say that we were even acquaintances.

The personality that fans see at conventions appears to represent a reasonable, if slightly constrained, representation of the author I interviewed. Clear, focused, and thoughtful, I also noticed things suggesting that the interrogative nature of his participation in round tables and discussion panels at conference is part of his natural style of conversation. He always seemed to make that extra little effort to make sure he understood what I was saying or asking. However, he also understood the intent behind leaving some of the prompts and questions ambiguous as a way of allowing the participant the freedom to express themselves.

His train of thought wandered a little more in these interviews than it does at those conference appearances, but the one truly significant difference I noticed was that in the interview a sarcastic sense of humor is much more apparent than it was with the David Brin I knew from conventions. Some of his more notable novels include *Earth* (Brin 1990), *The Postman* (Brin 1985), and *Sundiver* (Brin 1980).

ORIGIN STORY

DB: I was born into the Sputnik Era. It went up when I was seven years old. I was already fascinated by science fiction stories of the time, which were pretty crude, but I read a Robert Silverberg tale called *Revolt on Alpha C* (Silverberg 1955). I had a fifth-grade teacher who encouraged us all to write, and write I did. Almost all of the tricks she taught us turned out to be completely wrong. But she encouraged us to get it on paper and I poked away at things, on and off over the years. Then in my freshman year at CalTech, the pressure was so intense that I started turning to fiction for a bit of a mental break. A lot of scientists have artistic hobbies. In fact, some of the greatest scientists I've known have artistic hobbies that they performed at a professional level.

I'm told that when I was four years old I saw Einstein play the violin. In any event, the pressure was substantial in my freshman year and so I started writing again. I've never gone back to that novel, but my sophomore year I started a novel that would later become thoroughly revised and become *The Practice Effect* (Brin 1984). Leaving CalTech and going to work for Hughes Aircraft Corporation I got started on *Sundiver* (Brin 1980) and finished it in three and a half years. My cycle is pragmatic. I would write the first quarter or fifth of a novel, edit it as best I can and then circulate the manuscript to as many people as I could find. I'd look for practical feedback. Especially about where they were bored, where they were unable to follow, where their attention drifted, so I could fine tune the mix and find the mistakes in how I tell the story. I would then rewrite it, build up momentum and write another fifth and repeat. It was quality control. Am I losing people in that next section or am I keeping them riveted to the entertaining parts of the story and getting them to put up with the philosophical or entertaining parts of the story? Then I would rewrite that 40 percent and build up momentum to add another 20 percent.

This all worked well for my personal flaws as a writer. Always I am worst at the beginning and that's the part that gets the most attention. I know how to end a story well. I really know how to end a story well, so the cycle of rewriting doesn't have to do much at the end. Part of it is, knowing what you're really good at and engaging what your flaws are. Clint Eastwood said, at the end of one of the most philosophical Dirty Harry movies, "A man's got to know his limitations." Of course, one way to solve that problem and discover your limitations is to get married. Then you'll get a dose of the corrective input that a wise man needs in order to not be extremely unwise.

I don't know if I gave an origins tale that was adequate. Many science fiction authors, certainly not all, but many, came into the field having been science fiction fans. They attended science fiction conventions and had met some of their favourite authors. Knowing about the Hugo Awards and things

like that, but none of that applies to me. I vaguely knew that there was some of that, but when I sold my first novel, to the first publisher . . . I don't have this wonderful J. K. Rowling story about rejections . . . Something I think was because I paid so much attention to quality control. I offer advice to new authors on YouTube and essays, about how they can get the criticism they need to get that kind of quality control. And I link to advice from a lot of other authors.

My publisher said "Well why don't you attend a science fiction convention in San Francisco?" I attended and was quite struck by the community. It was an amazing community of interests. But I was also a little nonplussed because I was a bit of a stranger to it. Three years later when the World Science Fiction Convention was in Los Angeles, my home town, I got to be the hot young newcomer and that was a strange experience.

Education, bachelors of astrophysics at Cal Tech. It was a difficult school. I'm not sure I should have gone there. I didn't have the world's greatest GPA but I have to tell you that I'm very glad that I went there. Half my education came from wandering the halls and knocking on doors and asking people what they did? That kind of curiosity is kind of what we try to inspire in readers of science fiction. You can double the effective education that you get out of college by attending seminars that aren't part of your curriculum and by randomly engaging faculty on a random floor in a random building and asking them what they do? Who's going to kick you out for asking about them? And if they do, all you have to do is knock on the next door.

Hughes Aircraft supported me getting a masters in optics at UCSD. It did the knocking on doors thing there as well and as a result, a Nobel Prize winner invited me to be part of his research group, which included full support and I got my PhD in astrophysics. And the European community was very kind to send a spacecraft and land on a comet and prove my dissertation.

COMPROMISES ON SCIENCE

DB: It all depends on the definition of what you call hard science fiction. Let me start by saying that only about a third of what we call hard science fiction authors, maybe a tenth of all science fiction writers, are scientifically trained. And yet that doesn't stop some former English majors from being wonderful writers of the hard stuff. Now, what do I mean by the hard stuff?

Hard science fiction is the stuff that tries for Einstein's *gedanken* experiment and trying to work out what might actually be a path of human destiny. In order to do that you have to bring in not just science and technology but also some instinct for the way human psychology and all that is involved. But above all, the thing that transfixes all science fiction authors is history. If

we think about it, that is the great drama, that should transfix anybody. This panoply of horrible mistakes made by our ancestors. This incredible tale of three steps forward, two steps back, and five to the side. That even our most well-meaning ancestors committed the most horrible crimes because of the assumptions of their time. The poignancy of history is the great story and what does science fiction do? Science fiction is not about the technology, it is about the science. It is about the process of change. It is about extending this incredible story of history through these thought experiments to extrapolate possible extensions of that drama into the future. Or possible alternative paths through alternate histories.

Only one in ten science fiction authors may be scientifically trained but all of us read history. It is the core topic that we share, and science fiction should not have been named science fiction. For one thing it led to incredibly stupid bigotry against the genre on university campuses. It should have been named speculative history because it speculates about possible extensions of history. It speculates about what might have been or what could be. Science plays a role in all of this, but only sometimes as the central character. Much of the time science plays a role as the medium by which change arrives upon the scene and slams into the characters. It confronts them with dilemmas that we may face in ten years, or forty years or two hundred years.

Now my view is that those three time frames, the near future, the intermediate future, and the far future have very different needs in a novel. Michael Creighton specialized, all but twice, in the near future. He always posited that it was our world that he was writing in, except for some imbecile scientists who were secretly doing some stupid thing that turns around and bites them. What most people don't stop to notice is that while he is ranting that science can't be trusted, in fact, the core failure mode in all of his books is the secrecy. And that is not what scientists generally do. Scientists do seek the self-correcting process of publication, critique, and transparency and openness. Science is generally the most open world and generally scientists like their errors to be caught by other people. That's how you get better.

That's philosophically what I believe in anyway, as might be obvious by the way I do quality control on my own work.

Hollywood is propelled by the idiot plot, and that's the assumption of stupidity, because that drives mistakes and that lets you put your hero in pulse pounding jeopardy for ninety minutes. That explains why we have so many dystopia and catastrophe stories today, but only a few of them serve the function of warning about a failure mode.

The best of those few work because they're what's called the self-preventing prophesy. *Soylent Green* (Fleischer 1973), a prophesy in the

1970s made by millions of environmentalists. *Dr. Strangelove* (Kubrick 1964) and *On the Beach* (Kramer 1959) helped us to avoid nuclear war. And the granddaddy of all self-preventing prophesies George Orwell's *1984* (Orwell 1949), which girded us with a metaphor that we all use when we see a possible Big Brother looming on the horizon. The difference between a decent moderate person on the left and a decent moderate person on the right is who they think is trying to be Big Brother. The moderate left thinks its conniving aristocrats and faceless corporations, the moderate on the right thinks its snooty academics and faceless government bureaucrats. Unfortunately, there're almost no decent, intelligent, calm and negotiating people on the American right anymore. We're hoping they'll get over their fever and we apologize for them. On behalf of blue America I apologize for their re-ignition of the American Civil War, phase 8, and when we go into these spaces we're a little bit crazy.

So what I was talking about was these three phases of the future and telling a story and Michael Creighton thriller novels. These deal with the idiot future and some one thing that has changed. They're really easy to write. The distant future is also somewhat easy to write. You need to ideally bring in some science as I have in my uplift universe. The science of biological engineering of dolphins and chimpanzees to give them full equality with human beings . . . possible science about ecosystems of different planets . . . but when you assume a warp drive, when you assume that in the future we and the aliens will have ways to zip around the cosmos, you've already decided to play tennis with the net down.

So I don't consider that to be hard science fiction. Hard extrapolative science fiction. And because you are playing with the net down, with hyperdrives and those kinds of things, you can either make a declaration that hyperdrive is the given, now I'm going to respect all the laws of physics except for that, but it's still exactly what I would call hard science fiction. Some do. People often put my uplift series in that hard science fiction category, but I don't think I actually wrote hard science fiction until I wrote *Earth*.

Earth (Brin 1990) and *Existence* (Brin 2012) are set in the forty- to fifty-year time frame, and that's the hard one because you have to deal in a world in which you maintain fealty to all the physical laws and yet some breakthroughs have happened. You have to deal with the fact that if you teleported your young self from forty years ago to today, that kid would spend half his time going wow, we never thought of that. But the other half the time he'd have a disappointed tone when he said "you mean you're still doing that?"

To catch that mix of excitement and disappointment is to have a very wide stance when you write these kinds of books.

INTERACTIONS WITH SCIENTISTS

DB: Travelling around as I do and meeting scientists and people involved in the technology industries certainly helps me in my writing. It also hinders my writing because I'm so busy doing so many of those things. The conventions and the speeches and things like that.

I earlier mentioned that a bunch of the best hard science fiction writers did not have scientific backgrounds, well then how do they do it? People like Greg Bear, Nancy Kress and Kim Stanley Robinson, who couldn't parse a differential equation if their life depended on it. And yet, they really, really did solid extrapolations of science and technology. The reason is that scientists love this stuff and that makes it really easy to go to a nearby university and get to know some of the scientists in the field. At most, your expense will be pizza and beer, for consultations that they would normally charge thousands of dollars. Sometimes they hold out for a Tuckerization, and that is where you are required to name a character after them. The really savvy ones demand not only a character, but that character has to be involved in something sexy or a gruesome death. I've killed the head of the planetary society and all kinds of other scientists in my novels. We all know how to do this.

THE TEACHING MOMENT

DB: We're all members of a civilization, and science fiction authors more than anyone else that were in a delicate and difficult phase here. The Fermi Paradox, wondering why we haven't seen signs of earlier civilizations in the galaxy. One of the major hypotheses is that it's just too difficult to make it across the adolescent phase, when there's so many ways that we can screw it up. So apparently, other alien species have screwed it up.

One of the ways in which we can deal with this is through science fiction. That is the literature of exploring possible paths into the future. Through fictional tales we can poke our sticks a little bit ahead of where the scientists are poking theirs and possibly find some quicksand, land mines, pongee stakes and snake pits before we step into them. And that's the purpose of what I call the self-preventing prophesies. One of which, even though it was never intended as such, is Karl Marx's *Das Kapital* (Marx 1867) and, I hope it will turn out this way, Ayn Rand's *Atlas Shrugged* (Rand 2005). By pointing out potentially disastrous paths that we might go down, they show us how we can avoid them.

Without being self-preventing prophesies of such grandeur, nevertheless we create novels that inspire people to say, here's a set of problems let's be

aware of them as we're moving forward. So a lot of the science fiction about artificial intelligence is being discussed today in that context.

So being aware of good possibilities and being aware of dangers is one of the things that we do in the genre. The fact that it's not celebrated on American university campuses is reflective of how alienated and threatened many people feel by a genre that can perpetually ask questions of eternal human verities.

So what's the teaching moment? We try to expose the potential failure modes of human civilization and potential opportunities.

BETWEEN SCIENCE AND SOCIETY

DB: We've established at UCSD the Arthur C. Clarke Center for Human Imagination. UCSD won hands down because it is a campus that was already utterly devoted to the notion that we have solved C. P. Snow's problem. About fifty-five years ago, C. P. Snow gave a lecture that was very widely discussed about the two cultures on university campuses. One was how the humanities, history, arts and literature seemed to speak a version of English that was incomprehensible to the science side and vice versa. They were actually speaking a different language and there was no point in them trying to converse. And he said that if this was going to be solved someday, it would probably be solved by the scientists because he knew that a lot of the good scientists had artistic hobbies.

Well, out in California, in San Diego, the Snow era is over. There are so many collaborations between the arts and sciences that the notion of defending stern boundaries of interest is anathema. When I was at CalTech many years ago, it was not anathema. It was something that older scientists did. So this is a process of mental change. It's going on in our lifetimes and you're starting to see this in the respect that science fiction is shown now, in comparison to the past. Less so on more traditional university campuses, though it's starting to crack those as well. In New York, in the literary community, it used to be that every few years *Harper's*, *The Atlantic* and *The New Yorker* would take turns commissioning a hit piece against science fiction, but not in the last decade. Science fiction is now a topic of interest on the pages of these magazines.

WHAT SHOULD I HAVE ASKED?

DB: Your central concept (for this book) is about the relationship between science fiction, science and society. Well, one is the classic question that

most people ask and that is what is science fiction's role in inspiring people to become scientists. That's the one that is usually asked but you didn't.

Another one is about whether or not science's interaction with science fiction will advance to the point where it's so fast that it becomes something like real time interaction rather than us looking ahead five years. If you take that even further, then might the AIs compete with authors and render us obsolete?

Chapter 8

Brenda Cooper

How do you expose more people to science fiction in a way that they are not disdainful of it? How do you let them know that science fiction has become this broad conversation about the future?

—Brenda Cooper

The interview was my first meeting with Brenda and our correspondence in regard to setting up the interview was brief and included no extraneous elements, so there were no past interactions to create a context that might have influenced her responses. We were pressed for time, having had to schedule the interview between two of her conference appearances, so despite some hints that she would have liked to have explored the questions and prompts more thoroughly, she appeared to make a conscious effort to keep her replies succinct. Her more prominent works include *The Silver Ship and the Sea* (Cooper 2008), *Edge of Dark* (Cooper 2015), and *Wilders* (Cooper 2017).

ORIGIN STORY

BC: My dad was a rocket scientist, so I don't remember ever being not interested in at least engineering. He worked on the Apollo program so we would sit down during the Apollo launches and watch them go off. He also worked on Skylab. It was only up for a while and after that he worked for McDonald Douglas and their space station simulation program. So I don't ever remember not talking about those kinds of things with him. I think a little bit of that was, frankly because at the time my parents thought I would be an only child, so even though I was a girl, my dad was perfectly happy to talk about science

and technology with me. Given the way things were back then, it might have been different if I hadn't been the only child there.

So I was always interested, pretty rabidly interested, in both how the world works and the future. I've always been interested in where we are going. I've always wanted to fly in space. I probably won't at this point, but I've always thought that exploring, and space travel and stuff would be very interesting.

I grew up reading Heinlein, which was largely social science fiction in some ways but I also I read a lot of Arthur C. Clarke. I really remember *2001* (Clarke 1968) and *Hal*. I've always written about AI so that probably had an impact, *Rendezvous with Rama* (Clarke 1973), and Asimov's *I Robot* (Asimov 1950). Oh and Larry Niven. I've since written with Larry but back then, *Ringworld* (Niven 1970) just blew me away because of the scope of the ideas. So mostly I just read a lot of science fiction when I was a kid and I liked both social science fiction and hard science fiction. I really like both.

COMPROMISES ON SCIENCE

BC: Not really. Characters are characters, not real people and that's as much the same for scientists as it is for any other profession and I usually keep the science itself pretty accurate, or at least plausible.

INTERACTIONS WITH SCIENTISTS

BC: I have worked on some specific projects sort of about depicting real science. I have a story in *Hieroglyph* (Finn 2014), which is the ASU story collection where they paired us up with scientists to talk with them before we wrote the stories. I didn't get paired with a specific person but we did a lot of work with our ideas and stuff in groups on a website before we wrote the stories and I worked with a futurist named Glen Hiemstra. He is both a technology futurist to some extent as well as a social futurist. As part of that he also reads a lot of science fiction. He often recommended science fiction books that integrated old science into stories as a way to tell people, to communicate some of the basics of science to people. These are things people need to think about because stories today are more visual.

The futurist community is growing rapidly, and there's a whole company researching science fiction futures, they basically go into Fortune 500 companies and they talk about the business these people are in. They use science fiction to convince the executives to think far enough outside of the box to realize what might be happening. More and more science fiction stories

are being used as a way to communicate even inside of businesses. So I'm involved in a few things that have to do with that.

TEACHING MOMENT

BC: Well I'm going to give you two answers to that. Science fiction allows the teaching moment to happen across time and place so you don't have to be there with the student. I write a story, it's like I'm there as a teacher whenever the reader picks up the book. There's something significant about that. I've gotten emails from people that I have never met, in other countries, that are reactions to things in stories I've written. Those can be teaching moments.

The other thing about the teaching moment that I want to say is that the reason that we're seeing science fiction stories used more and more in business environments to talk about the future is because it puts an emotional content into what people are learning. I think people learn about things that have that sense of raw emotional better than to dry words on paper. So let's say you have a business scenario that says in a mere five years from now we're going to have robotics helping all of our grandparents in their homes. Alright that's fine, but if I write a story about that and I've got a grandmother, and I've got her reaction to the robot, and I've got her daughter, granddaughter, helping her through it . . . something like that scenario comes to life for someone. They get that teaching moment because you've wired into their emotional sense instead of just their brain.

BETWEEN SCIENCE AND SOCIETY

BC: Let me start with scientists that do not read science fiction. In a way I can understand why they might be leery of it because sometimes we don't get the science as exactly as they do, and maybe they should forgive us for that. We talk to them a lot about science, but we still don't have the deep knowledge of the topics that they do. But I think what we really offer to scientists are insights into the surprising ways that science may impact society. I find that often when I talk with scientists, they're very focused on the reasons they're doing the research but they're not as focused on the potential unintended consequences of that research. That's one of the things that science fiction writers can often find because we are digging for those unintended consequences because that's what makes the story interesting.

So I think that's what I would say to them is be kind to us on our science, we know we're not you. But also, we may be able to bring to the table some innovated things to think about how that science may be implemented.

To the general public I think I serve more as a futurist. When I give futurist talks, I often recommend that they read science fiction. Not just any science fiction because obviously reading David Webber is not going to inform you about any near future trends. You'll have a great time and you'll love the book, but it's not that sort of thing that you'll learn something useful from.

But in those futurist talks, I will recommend authors who I think are presenting the science well enough for people to imagine what might be happening a few years down the road. We tend to lose track of the speed of change in the world around us. Some things seem to never appear, and we all have certain technologies that seem to be coming slower than we want it to. Like, I don't have my jetpacks yet. I don't have my personal robot yet. But there are also a whole lot of changes happening faster than we realize or faster than we want, and we often lose track of that in our day to day life.

Science fiction is a way to help people get their minds around those differing paces of change by exploring what are some of the important questions of the time. What were some of the most important questions of a half-century ago? Science fiction can be a beacon toward good things that could happen, a warning about bad things that could happen and sometimes just a good way to ingest some science that you might miss if it was presented to you in a less interesting medium or less immersive medium.

WHAT SHOULD I HAVE ASKED?

BC: The question is how do we get normal people who are not geeks, but care about the future, to be interested in science fiction. I don't know that I know the answer to that, but I think that's one of the important things to talk about. Say I'm talking to some parents at our daughter's school. If I'm talking with people who are not part of this fan community, when they find out I write science fiction they often just sort of turn off. They're not interested. They see it as the pulp fiction that they saw when they were young and they don't realize that science fiction has so much more than that. So how do you expose more people to science fiction in a way that they are not disdainful of it? How do you let them know that science fiction has become this broad conversation about the future?

Chapter 9

Stephen R. Donaldson

I see my job as the pursuit of a wider body of understanding, but the mechanism is simply one of trying to tell the stories as honestly and effectively as I can.

—Stephen R. Donaldson

I originally “met” Stephen back in the 1980s.¹ I had just made the rather sudden and severe shift from studying theoretical physics to studying politics and communication, but I was still part of several of the early computer forums on physics and cosmology when he joined a discussion board about speculative physics and began asking questions about how someone might destroy a black hole. After several weeks of exchanging what was at the time the very new-fangled thing called emails, he added his last name to help frame the boundaries (or lack thereof) of how far “out there” he was willing to go with what had become some rather wild speculations about finding ways to force black holes to emit Hawking radiation. Every once in a while in the years that followed, we have exchanged a few emails, and he was the first significant author to read one of my novels, for which I am still grateful. When I initiated this project, he was one of the first to agree to an interview.

Stephen is primarily known for his fantasies, the Thomas Covenant series being the best known, starting with *Lord Foul's Bane* (Donaldson 1977), but his Gap series of science fiction novels, which start with *The Gap into Conflict: The Real Story* (Donaldson 1991), were the basis for his inclusion in this study.

ORIGIN STORY

SRD: Let me start by saying that my background is in English literature. I wasn't an academic for long, but that's still the background from which I came into writing fantasy and science fiction. I came into writing from just the excitement about storytelling. That was informed by the study of literature throughout college and graduate school, and then further energized by Tolkien.

I came along at a time when he was hugely popular and had no critical reputation at all. The intellectual world I was in sneered at Tolkien and fantasy more generally, but I didn't. So part of what inspired me to write a big long fantasy about an unbeliever was to try to confront the questions that my colleagues were not. Why was I able to take it seriously as literature and they were not? What was missing? Was I missing something or were they missing something?

Once those doors opened, all kinds of things became possible that had not been possible for me before. As an opera buff I had fallen in love with Wagner's Ring Cycle and I had always thought it would be cool to write some kind of epic fantasy that was loosely based on that material. However, after I had, in a manner of speaking, established myself as a professional writer but also having established myself within myself in terms of how I wanted to tell stories, I realized that what I had been imagining in terms of this story based on the ring cycle, was only going to work in science fiction. It simply could not be told within the kind of parameters that I feel that fantasy necessitates. Science fiction opened doors in my head.

My knowledge about science is fairly rudimentary, especially in comparison to many of the others who have written science fiction. My interest, especially in physics and biochemistry, is very strong. I love few things more than listening to people talk about those subjects. As you may recall you helped me with some points on the science in the Gap novels, and other people have helped me as well. I do some research on my own to try to fill in the gaps in my knowledge. Ultimately, I gave myself permission to make up some things and my job was to make it sound plausible to my readers.

I'm a child of fundamentalist Christian missionaries in India. My parents were medical people, but they were all missionaries together. I never knew anybody who wasn't a missionary during my childhood. It was a very intellectually hermetic world. Leaving aside the medicine, it was a world that generally thought that science was not something to be trusted because scientists are forever trying to tear down Christianity.

My own reaction to reading was different to what the environment around me encouraged. I've always said that aside from the Bible, missionaries read three things: *Time Magazine*, *Reader's Digest* and mystery novels. Somehow or another, mystery novels were okay, I never was sure why. In middle school I stumbled on the C. S. Lewis Narnia novels and that was my first exposure to

anything that might be called fantasy. These books are always going back and forth. Periodically new students would arrive at the school and they would inevitably bring and share some of their favourite books. As it happens my first exposure to science fiction was enormously exciting and I was enormously lucky in the books I was exposed to. There were only three: Alfred Bester's *The Stars My Destination* (Bester 1957), A. J. Budrys's *Rogue Moon* (Budrys 1960), and Theodore Sturgeon's *More than Human* (Sturgeon 1953).

They set my brain on fire and I developed a passion for reading science fiction, which, when I finally moved to the United States to attend college, I was unable to satisfy. I didn't know anybody who read it, so I'd just go to a bookstore, or even a grocery store and just grab whatever I found that was labelled science fiction. It was all junk. It was all terrible. So then I just kind of drifted away from it, because I didn't think there was anything worthwhile in it and nothing that would compare with the excitement I remembered from those first three books.

Later I learned that that was not true. It was the person who introduced me to Frank Herbert's *Dune* (Herbert 1965) that changed the trajectory of my reading, back toward science fiction.

COMPROMISES ON SCIENCE

SRD: I would say, no. As far as I know, the only scientists I've written about are in the Gap books and they're not the protagonists. My main technology wiz is a technology manipulator. It's not the same thing as being a researcher or a scientist. He likes to talk about Heisenberg, because of the uncertainty principle, which governs a lot of the parameters in which he makes decisions. But he makes decisions largely to do with the intersection of politics and machinery, if that makes sense. Applying technology to the control of human behaviour. His actions involve data acquisition, but that's political. Its power oriented. It's not research oriented. He has people working for him who are far more dedicated to discovering the truth about things. They are much less ambiguous characters. They will go to any length, not to serve an agenda, but to find out the truth. Other than that, I can't honestly say I've written all that much about characters who are scientists.

INTERACTIONS WITH SCIENTISTS

SRD: I have to say, my brother's a rocket scientist, literally. He helped design some of the Mars rovers and he's at least partially responsible for the fact that they actually work.

One of the things that haunts our space program, and I suppose space programs generally, is that the people who write the software really don't want to be limited by the constraints of the hardware. Every time NASA launches a science mission, they're launching a mission that they know doesn't work, because the software won't cooperate with what the hardware can do. So one of my brother's jobs becomes debugging it while it's in transit so when it lands somewhere, it will actually perform the mission it was designed to do.

We talk a lot about science, mostly about the physical sciences and stuff that would never cross my path otherwise. So he's been a great resource.

I did read *A Brief History of Time* (Hawking 1988), which was a challenge for a man with my background. Every single sentence was lucid, and every page I understood, but by the time I got to the next page I was at a loss for what I had read. It just kind of frayed away and I couldn't understand it cumulatively. Which, as it happens, was one of the areas you helped me with. You know, whenever I can find somebody who knows a bunch of stuff, I'm always fascinated to either pick their brains about something specific or just listen to them talk about their work.

THE TEACHING MOMENT

SRD: (Chuckling) You mean at what moment did I decide that I wasn't born to be a teacher? My teaching experience is very limited. I taught freshman English as a teaching fellow in graduate school. I have co-taught a very small number of writer's workshops. And I have taught Karate. Teaching a physical skill turns out to be something I enjoy a whole lot more. Every two or three years I go back to my alma mater and they want me to have a visiting author seminar and I do that, and I feel like I have a lot to offer. By which I mean that I can offer them the things that I wish someone had offered me when I was in their position. But it makes me anxious as hell and I don't enjoy it for a second.

So I don't think of myself as a teacher at all. I think of my stories as being ways of asking questions. I try to make the stories interesting in a way that they prompt the reader to engage the questions the story raises. I suppose I could call that teaching, but that's a little far beyond my expertise.

BETWEEN SCIENCE AND SOCIETY

SRD: If by standing between you mean that it is somehow my job to either transmit a relationship between them or, what my parents would have preferred, to block such a relationship, no, I don't see any of that at all.

I think it's my job to understand my characters as deeply as I possibly can and to tell their story in a way that makes them accessible to other people to understand. Ultimately, I believe that storytelling is the only escape from the prison of the human skull. Now, we're all stuck in there. We have a huge amount in common but we cannot convey it except by telling the story. Telling the story of who we are. Telling the story of what happened to us on Tuesday. Telling the story of people other than ourselves. So, I see my job as the pursuit of a wider body of understanding, but the mechanism is simply one of trying to tell the stories as honestly and effectively as I can.

WHAT SHOULD I HAVE ASKED?

SRD: You know when I read the material that you sent to me (for the interview) I came across the part where you mention falsification science and that struck a very idiosyncratic and what you might call an idiopathic chord for me. For reasons that are not germane to this interview, I have become really interested in how science is misused in the field of medical research. The scientific method is clearly a very powerful intellectual tool, and when it is misapplied, the result can be powerfully dangerous.

So much of medicine as it is practiced in the United States these days seems to me to be indistinguishable from barbarism, because it all involves these completely bogus applications of the scientific method to various test subjects. Claiming to obtain results which are somehow valid for the treatment of individuals who are sitting at the doctor's office, but are in fact, things that having nothing whatsoever to do with the person being treated.

When you read these popularizing books about medicine, about what questions to ask your doctor, or what do you need to understand, why is this bad for you . . . if you read them they're just all full of not just intellectual bullshit but scientific bullshit. If you eat a high-acid diet you're increasing your risk of diabetes by 56 percent. You have to read for a long time to find out that this only applies if you're a woman, and it only applies to the 5 percent of women who actually get diabetes, and in the real world this 56 percent increase is actually 1 percent. But people read this stuff and think they've got to change the way they live or they're going to die.

It just drives me insane, which has nothing to do with any of this, but it is what sprang to mind when you said you wanted to talk about science.

NOTE

1. We conducted his interview via Skype, so to this day, we have still never met face to face.

Chapter 10

Eric Flint

I think that the biggest misconception that I run across about science is a notion that assumes that there's such a thing as the ideal form of science, physics usually, and that all other intellectual endeavours are more or less shadows of that idea form. I think that's a wrong-headed way of looking at it.

—Eric Flint

I was introduced to Eric at the World Science Fiction Convention in Spokane, quite literally moments before we started the interview. It was just a coincidence that we were introduced by one of the other authors in the study right at the start of one of the few breaks in his conference schedule. I have read a tremendous amount of his work, and his alternate history novels have a prominent place in my work using fiction to teach politics. Other than his fiction, I knew almost nothing about him before we sat down to talk. Eric is best known for his twist on alternate history Grantsville series, which begins with *1632* (Flint 2000).

ORIGIN STORY

EF: I'm not sure there was a catalytic moment in my case. On my twelfth birthday, my mother bought me a copy of Robert Heinlein's *Citizen of the Galaxy* (Heinlein 1957) and I read it and I was very taken by it. Then I went through my school library and found a copy of Andre Norton's *Star Rangers* (Norton 1953) and Tom Godwin's *Space Prison* (Godwin 1958). That got me started in science fiction. About two years later I started writing

fiction myself and I just kind of automatically started writing science fiction because I had been reading so much of it. That's what got me interested in it initially. I wrote quite a bit in high school and college, including a couple of novels. I paid a professional typist to type up the manuscript and submitted them to Ace Books. They rejected it. I sent stories to the magazines. It got a lot of rejections, including a nice two-page long rejection letter from John Campbell, and then I got politically active and became just completely engrossed in it and I just stopped writing.

So I didn't write anything for about twenty-five years. I was in my mid-forties when I started writing again, and I automatically went back to science fiction partly because I had an unfinished fantasy novel I wanted to finish and partly because that was what I had always sort of written. I also thought about it and decided that I would have more creative freedom in science fiction than in any other genre and at this point in time I consider what is called literary fiction to be a genre.

Formal education includes a BA in history and an MA in African history and if you look at my science fiction, in one way or another, it's all very historical. I'm best known for the Alt History stuff but even my other stuff is very historical. My first novel, *Mother of Demons* (Flint 1997), the plot of it is heavily based on aspect of Southern Bantu history in the early nineteenth century, which, by no coincidence, was the subject of my dissertation.

COMPROMISES ON SCIENCE

EF: It doesn't bother me. One the one hand, characters are smaller than life because you have to eliminate all kinds of things that are just not germane to the story. So even when people talk about multi-dimensional characters, even if it's by Shakespeare, I don't care who it is, are not as full and complex as a real person. There's no way around it. However, it's also necessary to have a coherent story. So you're emphasizing that when you create a character. And it's also true that characters are larger than life, heroic in slightly bigger than life ways and that sort of thing.

A story is essentially analogous to an impressionist painting rather than to a photograph. It's just in the nature of the beast and it's not just the characters. You will leave out all sorts of things that you assume that the reader will fill in, and if you've done your job properly they will. The negative space, as you call it, the aspects that are left for the reader to imagine as they read, is enormous. What a writer is essentially providing is a sketch and that's just the nature of the art form. There's no way around it. So your scientist as a character is going to be an impressionistic sketch of a real scientist. I don't find it to be a problem. It's just a question of if you do it well enough.

It can be done badly. There's no question about that, but there is a difference in my mind between a one-dimensional character and a caricature. A character, especially a minor character, can be one dimensional, and that's okay, as long as that dimension is depicted well and adds something important to the sketch you're using to feed the reader's imagination.

THE TEACHING MOMENT

EF: I'm not quite sure what that prompt means, or is meant to mean, but as is true of most authors, including those who write in other genres, there's almost always a point you are trying to convey. There has to be a point to a story, or else it's not a story. Another way to say that is that every story is about something. In its simplest form, every story ever written has two elements. They start with "once upon a time" and they end with "the moral of this story. . . ." Now that moral may be pretentious, or it may just be don't wander off into the woods, but there will be a lesson to be taken away from every story. Even if the author isn't really intending that, it's there. If it's not there, then you don't really have a story.

The best way I can explain that is with a mental experiment. Anybody can write down what happened to them yesterday. You have a sequence of events from when they woke up until they fell asleep. You have character, it's coherent, but it's not a story. It's not a story because there's no arc to it, there's no point to it. And that point, that's something that you might call a teaching moment.

Another way to explain it is that a friend of mine is a professional photographer. What he can do that I can't is that he can look at exactly the same scenery that I look at, but we don't see it the same way. He will see that if he frames it a certain way it will be a striking picture, but I just can't see that frame or what the frame means in terms of how people will see that picture. So what a storyteller basically does is take a sequence of events and envision how you can frame it so that you create a point from it. In that sense, all story telling is instructive. That doesn't mean that it's profound, or even meaningful. It could be simple or stupid, but it's there.

BETWEEN SCIENCE AND SOCIETY

EF: I think that the biggest misconception that I run across about science is a notion that assumes that there's such a thing as the ideal form of science, physics usually, and that all other intellectual endeavours are more or less shadows of that idea form. I think that's a wrong-headed way of looking

at it, because all scientific work is approached with the same basic intent. Scientists want to find out causes, or why things happen the way they do, by assuming that the causes themselves are natural and explainable. They start by ruling out any supernatural or mystical causes. They may exist but that's not what you're interested in.

The thing is, a lot of reality cannot be approached the same way as physics. Physics usually deals with very simple things. Even the things that seem complex, like subatomic particles, are simple in comparison to messy subjects like biology. And if you're dealing with anything that has a degree of consciousness in it, you're adding another degree of complexity that is at least another order of magnitude. Furthermore, a lot of people equate scientific work with experiments, but a lot, maybe most of the things scientists study, can't be put into an experiment. It's not just simply true of studying people. It's true of most biology, either because the subject is too vast or too interconnected with other things, or the time scale of change is too long.

So what you have to do under those circumstances is, as much as possible, use comparative methodologies. Astronomers do much the same thing. You cannot watch a star evolve, nor can you make it evolve in a laboratory. What you can do is compare different stars and out of that draw some conclusions about the evolution of stars.

It's harder when you're dealing with humans and human systems, because the subjects are much more complex, but the timeframe is also much more compressed. As Carl Sagan would say, you have "Billions and Billions of stars spread across billions and billions of years." Human societies are nowhere near that numerous nor are they anywhere close to that old so that counters some of the difficulties of humans being so much more complex than a simple physical system. Still I suspect that we aren't truly going to understand the human species, animal, condition or society until we encounter an alien species so we can actually see something to compare ourselves to.

So, the point being that the levels of complexity and difficulties approaching a subject matter vary greatly from one field to another. That does not mean that any of them are less scientific, it's just that they are being approached in different ways than scientific experiments. You believe in a rationalist explanation and in trying to find it you are moving out of a speculative realm of explanation. I think it would help everybody, both scientists and the public, if we were to have a better understanding of the differences in pursuing that same end, because there are a lot of misconceptions.

A lot of what science fiction does is to serve as constant mental experiments that are being done where the author posits these alternate variants, either the future or the past or whatever, to what we actually see. And that kind of comparison, like with stars or across biology, it teaches us.

This is basically the way I look at things. What stories are doing is human beings are holding up a mirror to themselves and trying to understand themselves better. Science is doing somewhat the same thing but not just about people, but a lot of the methods are similar, particularly in the role of mental experiments.

WHAT SHOULD I HAVE ASKED?

EF: I don't know if there are any. These were actually quite good. Honestly can't think of anything.

Chapter 11

David Gerrold

Science fiction functions as the research and development division of the human race.

—David Gerrold

In many ways, David Gerrold is the person who made this entire project possible. When I began pursuing this study, I was confronted by a twist of logic that can make sense only in the context of a British-style academic environment. The approval of an interview-based research project is contingent upon positively demonstrating that I could secure the interviews, but I was not allowed to solicit interviews until the research project and the accompanying ethics authorizations had been approved. The effect of this was exacerbated by the approving committee's awareness of the absence of goodwill between the academics studying science fiction and the writers of the genre, which led them to expect that I would be unable to secure the interviews. David helped me resolve this chicken-and-eggism by offering to serve as an intermediary between myself and the authors he knew, and by saying that he would be happy to be the first author interviewed.

This offer of assistance is typical of David. The only reason I knew him at all was because I had previously contacted him out of the blue to ask his professional opinion on a sensitive professional issue. I had been asked to adapt a controversial writer's work for a screen project, and I was worried about the impact that might have on my reputation as a writer. That conversation was extremely helpful. We followed it up with the exploration of bringing some of David's work to the studio I write for, and, even though that never made it past the initial stages of inquiry, we continued to interact via social

media and an occasional email. David has also suffered my occasional bit of fan-boyism with exceptionally good grace, autographing a copy of the *Tribbles* script for me. David wrote the *Trouble with Tribbles* episode of *Star Trek* (Gerrold 1967), which is the first piece of science fiction I remember and would be one of the first works of fiction that I would point to if I were to discuss the moments of inspiration in my origin story. One of the early “Grown up” books I read was the novel he co-wrote with Larry Niven, *The Flying Sorcerers* (Gerrold and Niven 1971).

ORIGIN STORY

DG: I was probably around five years old and there were two TV shows on ABC. They were nighttime serials, fifteen minutes each, and they were both broadcast live because tape hadn’t been invented yet. The first one was *Time For Beany* (Clampett 1949). It was a puppet show and Stan Freberg did the voices. And the second one was *Space Patrol* (Darley 1950) and that was broadcast live. *Space Patrol* was about Commander Buzz Corry and Cadet Happy on the spaceship Terra 5. I remember a couple of the adventures, but what was most fun was that I wanted to be on that spaceship. *Space Patrol* lasted two or three years and by then I was reading books. I worked my way through the library. *Doctor Doolittle* (Lofting 1920) and *Freddy the Pig* (Brooks 1927). *Freddy the Pig* actually had some science fiction adventures and I absolutely loved those. Those were the ones I remembered. And of course the comic books. Carl Bark’s Disney stuff was very science fiction. *Tales from the Crypt* which was the horror stuff.

I was going to the Van Nuys public library once a week and checking out ten books, which was the max, and I went through everything in the children’s section. I discovered *Rocket Ship Galileo* (Heinlein 1947) by Heinlein, and then there was *Between Planets* (Heinlein 1951) and *Space Cadet* (Heinlein 1951) and *Farmer in the Sky* (Heinlein 1950) and *Red Planet* (Heinlein 1949), which I think was all the kids books he had done at the time. Then I went to the card catalogue and found that there were more Heinlein books in a different section, and those books were in the adult section but only two shelves from the bottom, so I snuck over there and sat on the floor and read them. When I finished off all the Heinleins I started on the Asimovs, and then Van Vogt, and then Murray Leinster and by then I was a teenager. I was reading a book a day, buying books at the newsstand and the next step was the used bookstores. I eventually collected a complete run of *Galaxy*, and *Fantasy and Science Fiction*, and all the ancillary magazines that had shown up. I was keeping up with everything, so by the time I was nineteen or twenty was caught up.

So the origin story was that I was smallest and the shyest. I had various insecurity issues. The library is a great place to hide and science fiction was an escape. We knew this then, the fans knew that we went into science fiction as an escape, but here's this vision that you're going to go into space and build a better world. So, while I may have gone in as an escape, I came out the other side saying, "I have a vision that the way things are is not the way they have to be." It made me a very weird person, but it was a better way to be than just be another one of those cardboard people who thinks life is about cruising down Van Nuys Boulevard in a convertible, hamburgers on the weekend, 9 to 5 day job and sit on the couch on the weekends. I thought that that was such a shallow view of life, or maybe what life could be.

When you start thinking in terms that we are a blip in evolution. That we started this way and we're headed that way and we could go out to the stars, you have a vastly different perspective on what it means to be a human being.

INTERACTIONS WITH SCIENTISTS

DG: I interact with scientists as much as possible. I've been invited out to the Jet Propulsion Laboratory several times, and had opportunities to talk shop. After I wrote *When H.A.R.L.I.E. was One* (Gerrold 1972), Marvin Minsky was up and we went to dinner and talked ideas. And I get the real pleasure to get to meet astronauts once in a while and have the occasional conversation. Neil deGrasse Tyson and Bill Nye the Science Guy end up at some of the events I'm invited to and I get to talk with them. There's a weirdness to having someone you idolize a little bit, know who you are before you meet them. It's humbling, but I love sitting down with these people and having a conversation with someone who has a real scientific background, so . . .

Look, 90 percent of what I do is research. Thank god for the internet, and I love research. But after I research and research and research, reading everything I can get my hands on, there's still nothing like sitting down with an expert and having a conversation. And it's always a little flattering because they want to talk about *Star Trek* (Roddenberry 1966) so it's a real conversation, not just me picking their brains. You sit me down with a scientist and the conversation is never about a story, it's just that I want to know how the universe works.

I am so blessed that we're finally living in a time where we're developing tools to find stuff out, because if you look at all of history up until right about now, it was all bullshit mythology. The stars are where Zeus threw up and scattered little diamond twinkly bits of vomit. No! I want real science. You tell me that they're flaming balls of gas and I'm excited. Here's a blue one and a red one and a white one.

COMPROMISES ON SCIENCE

DG: The problem is that normal scientists spend a lot of time running this experiment, running this experiment, running this experiment, over and over, about the thousand times to collate the results and looking at the graphs and charts and then thinking and typing and peer review. That's about as exciting as watching paint dry. Meanwhile, if you're writing a story, a story is about a person who has a problem, and what does he have to do to solve the problem and what does the problem do to him when he solves it. So, you get the mad scientist syndrome, where the scientist is the enemy. You get all kinds of shorthand where the guy sits down at a computer and tap, tap, tap, the answer pops up immediately.

I don't do that in my books because it annoys the hell out of me when I see it. So, my people are working and working, or someone else has already solved the problem and they just have to get that solution. I respect the process. There's no credibility in science that is done in the snap of the fingers. Real science is test, repeat, test, repeat, repeat until dead.

The dissonance comes from storytelling requiring a different pace than real research. So, it's a time question.

Also, half the producers in Hollywood are idiots, and the other half. . .

THE TEACHING MOMENT

DG: I would say that first you have to set the stage for your story. That means that you're going to spend a large part of first chapter or two, setting stage. Here's the scenery. Here's the world. Here's the time. Here's the place. Here's the ecology. Here's the environment. In some stories it's really simple. The guy walks out the door and he's in twenty-first century New York City. So all you have to do there is just say the hustle and bustle of a city street. But if they walk out through an airlock to the surface of the planet Zargon or whatever, then you have to describe that the sun is this colour and the gravity is this and the atmosphere is that and he has to wear the space suit. You also have the culture associated with colonizing the planet and so on.

So the first thing you're doing is teaching the reader about the setting, but then after that you have to teach who are we and what does it mean and how has this changed us? So a good example is Ursula K. LeGuin's *Left Hand of Darkness* (Le Guin 1969), which is a totally different world. She doesn't deal all that much with the ecology. She calls it winter and it's just cold enough that it's in a permanent ice age, but not so cold that people can't live there. But the real point of the story is that they have a different sexuality and get to

the psychology of it. So her teaching moment is throughout the book as she demonstrates the relationships.

Larry (Niven) takes the time to do the info dump, but he holds off. Notice what he did in *Ringworld* (Niven 1970). What's that? It looks like a ring around a star. Okay and then, what kind of a ring, and they keep going. So each time he hits that he introduces one more piece of information to teach you that a ring around a star is possible. So he takes his time and it takes a third of the book and by the time you get to *Ringworld*, yes there's a ring around a star and by then you're willing to believe in it. Ursula K. Le Guin, same thing. She takes her time, but in a different way.

So the teaching moment is not, "Let's sit down I'm going to tell you all about this." Your teaching moment is letting the heroes discover the circumstances along the way. Some of it is necessary exposition. It has to go somewhere, but some of it is showing what it's done to the hero. The ecology of the moment. So you're teaching the character through his experiences and what he becomes and the reader is along for the ride.

There's a story I will tell you, it's a true story. Early in my career I was on a *Star Trek* panel, and I was sitting between Isaac Asimov and Hal Clement, two men who informed and shaped my adolescence. I'm thinking "what the hell are you doing sitting with Isaac Asimov and Hal Clement? Keep your mouth shut or the audience will ask the same question." But the first question came to me, and it was the how important is the science in science fiction question. My answer was "If I don't know something I call Isaac and if he doesn't know he calls Hal." And I passed the microphone to Isaac.

I think that scientific accuracy is the single most important part of a science fiction story, unless you are adding a bit of balonium, so you can make a point. So faster than light travel is balonium, but you're using that to get to the strange planet that has or is what you really want to talk about. Or time travel. But once you establish that balonium, you want to have it as close to the real science as possible. Larry (Niven) and I had this conversation not long ago, that you're entitled to one point of balonium and if you're a really good writer, you can get away with two. Three is really stretching it but once you get to four, you're writing fantasy.

THE HOLLYWOOD QUESTION

DG: There's a specific shorthand for a book where you find the language in the description. So for instance the first chapter of *A Method for Madness* (unfinished novel) the chopper they're on is going to crash and there is a computerized autopilot. I checked with some aviation experts and they said call it a FAD PAC. The acronym was made up. So in the novel, I can take

a few sentences to say what it stands for, but if I were doing it as a movie, I wouldn't have the time for that, so there would just be the female voice saying "Engine overheating" or whatever, without explaining where the voice is coming from. The pilot might tell it to shut up, but that would be it. That would say there is a computer, I've got a nickname for it, and if properly shot and played, the audience would get it without the explanation. So, in the movie you have to present it visually. I could use the same dialogue in the book, but I would also explain it.

And that's the difference. In a book you have the space to add detail. A good example is, if you look at Tom Clancy's *Hunt for Red October* (Clancy 1984), that book is thick with explanations of the hardware. You look at the movie version and it's still a hardware movie, but nobody stops to explain it, they just show it. Same thing with *Star Trek*. We show you the transporter beam. We don't explain it.

BETWEEN SCIENCE AND SOCIETY

DG: Science fiction functions as the research and development division of the human race. We are imagining possibilities. We are designing and building the future that we're going to live in. We're the dreamers, the scientists are the theorists, and engineers are the builders. An example is the episode of *Star Trek* where they go to a library and everything in the library is on big silver disks. Well those were just phonograph records that had been spray painted with silver paint. Two engineers are watching the episode and they ask each other, "How would you store all that data on those little silver disks?" And they go to the idea of a laser that would reflect back, with pits that are half a wavelength deep so the light doesn't reflect back, and they went to the labs and played with lasers and reflections and invented the laser disk. The first laser disk recorded its signal as an FM signal, not digital, but it was the forerunner of the CD which recorded a digital signal because the technology of recording pits on a silver disk, etc. And if you trace that, *Star Trek* was here's the possibility, then the theory was developed and the engineers made it work.

Would that have happened without that moment of *Star Trek*? I don't know. Arthur C. Clark envisioned communication satellites in 1949. Later on scientists said there's a science here. Later on, NASA puts up TELSTAR. So the science evolves from the science fiction. If science fiction focused more on psychology, who knows what the technology might become?

What I would say is that we're all in this together. Some of us are extrapolating possibilities, some of us are figuring out what possibilities are actually possible, and some of us are figuring out how to make the possibilities reality.

That's how the world changes. Step by step. Mostly for the better. We have vaccines today that were not possible before we had the computers to model the proteins. We have batteries today for the same reason. We can map the human genome.

A lot of things are not cost effective. Or not even possible. But sometimes you get that thing that is not only cost effective it's going to change our world. So I would say let's recognize the concentric circles outward, or the ripples or whatever you want to use to see that we're all part of this larger process, including the people who are just reading and interested and create a world where we can peruse the future like that.

It's maybe telling scientists to dream, or dreaming for those stuck in that test-repeat-test-repeat cycle. Think outside the box.

WHAT SHOULD I HAVE ASKED?

DG: If I could answer that question I'd be the next Nicola Tesla. I don't know. Maybe we should just be constantly asking that question. Asking the question is more important than the answer. We're always going to get interesting answers but then asking what else is more important.

Chapter 12

Joe Haldeman

Every piece of fiction ever written is about time. It's about events that happen over the passage of time. Even if it's only a page long, that's what's going on, because it's all about causality and making sense of events. Usually it's strung out in a linear fashion, but that's what makes time travel the obvious science fiction story because you can alter that in ways that you can't in other fiction.

—Joe Haldeman

Larry Niven introduced me to Joe Haldeman, and, like many of the other authors, Joe was exceedingly generous with his time. Even before he finished shaking my hand, he was sitting down for the interview and I had to scramble to get things in order and get the bureaucratic necessities of permission forms and the formal descriptions of the interview out of the way. I knew a bit about Joe and his background simply because I often refer to *The Forever War* (Haldeman 1974) as part of my work using fiction to teach politics. The Vietnam War element of his personal biography is so relevant to that novel that some of his background has to be referenced and discussed to contextualize it. I also knew that much of Joe's fiction engages the concepts of time in interesting and expansive ways, but most of what he offered in the interview was completely new to me.

Joe's comments struck me as clear and succinct, creating the impression that the answers to the questions and prompts were obvious to him. He didn't need to explore his memories or consider a wide range of possibilities to try to find ways of communicating what he wanted to say. That succinctness led me to insert a few extra prompts, noted in the interview, to encourage him to expand the scope of his answers.

ORIGIN STORY

JH: There are two obvious books from when I was in grade school that serve as that starting point. One was called *The Handbook of the Heavens* (Bernhard, Bennett, and Rice 1935) and the other was *The Stars for Sam* (Maxwell and St. John 1931) both were elementary astronomy books and . . . I don't know, I just always loved the stars in the sky. I guess I was in fifth grade, when I first started getting *Sky and Telescope*, and I still get it some sixty years later. You know, most people don't think of magazines this way but it's true, they become a steadying influence on your life. I know that *Sky and Telescope* was that way for me. There's a rhythm, a habit to getting it in the mail and sitting down to read it. And, oddly enough, I ended up being the editor of their competitor magazine *Astronomy*. It was brief, I was the editor for about a month and I got into an argument with this producer and otherwise I might still be their editor.

I've got a degree in physics and astronomy, so that could have been my career path out of graduate school, but I had already sold my first novel when I got that job. When the editing job didn't work out . . . by that time I had won the Hugo and the Nebula and that pretty much simplified my career choices. I just kept writing.

DVB: At this point Joe again asked what else I might like to know, so I prompted him to comment on fiction or popular culture.

JH: There were a couple of movies that really helped conceptualize what science was for me. *The Day the Earth Stood Still* (1955) that just blew me away. That was a zero special effects science fiction movie. It's all about these creatures from outer space come and tell humanity to clean up our act or we're coming back and that really got to me. That was years before I wrote any science fiction. The first actual story I started writing when I was eighteen and I didn't finish it.

The first science fiction stories I wrote that were published were stories that I wrote for a college course in fiction writing and I sold both of them. So I always thought I'd make, not a living, but a nice sideline writing science fiction, but as it turned out, I never got an actual job so, that was good.

COMPROMISES ON SCIENCE

JH: I try to make the scientists in my stories accurate. I don't over-romanticize science. The main character in my current book is a senior research scientist. She's actually in her 30s so she's young for that kind of position,

but she's got post-doc work and so forth. She's not a hero type, but is on the ball in regards to science. And yeah, I have a sort of image of her as what I would imagine as an idealized scientist if I had pursued science.

I got far enough to get really disillusioned with the harder mathematics and mechanics of it all. It was just tensor theory, but trying to derive stuff that connected to meaning and ideas and make sense is difficult. That was when I realized that all I was doing was filling in the blanks. I was learning equations and applying them to more or less real-life situations and I was on the other side, looking at columns and columns of numbers and trying to turn them into an equation. I could do both of those things fine, but it was the meaning of those things that troubled me. How do you come up with a theory yourself and make up a question that has any meaning? Something that's not just parroting the primary thoughts of the questions that basically made up your education. It's difficult.

THE TEACHING MOMENT

JH: What you want to do is make it look as if you're not wearing the teacher's hat at all. That's part of the real difficulty of writing hard science fiction because the real science is important to the book, or it wouldn't be hard science fiction, but you can't be standing up there lecturing to the audience. It has to be worked into the warp and weave of the story. Which actually leads you to, at least subconsciously, setting up situations where the science needs to be explained in order for the characters to drive the plot. That's really kind of an art. It's so easy to see when it's done clumsily, because you have the action just stop while the writer explains something. That's deadly.

DVB: At this point he again asked what else I might like to know, so I prompted him to comment on his interest in deep time as a story element.

JH: Well, I guess I have always been interested in time travel stories, which is kind of like saying "oh I'm really interested in dragons" because what can you say about real time travel? If you wanted to call time travel a pseudo-science, I'd say "sure," but for all the scientific stuff that you could put into a story, time travel is the one that goes to the heart of the story. Every piece of fiction ever written is about time. It's about events that happen over the passage of time. Even if it's only a page long, that's what's going on, because it's all about causality and making sense of events. Usually it's strung out in a linear fashion, but that's what makes time travel the obvious science fiction story because you can alter that in ways that you can't in other fiction.

BETWEEN SCIENCE AND SOCIETY

JH: If you think about the function of science fiction, what science fiction means is stories with science as a central element, but what makes science fiction interesting are the ways it attempts to understand. One thing science fiction does that other genres don't is have people who are professionals in the ways of finding out about the nature of reality as central to the stories. This effort to discover what may be something that all fiction, or most good fiction, does because if you think about good fiction, when the story is done, you have learned something about reality. Otherwise why read it? But science fiction can start out with that as the conscious aim. It's not just about entertaining you, it is explicitly about questions like: Why are we here? What does life even mean? Why is the universe the way it is?

WHAT SHOULD I HAVE ASKED?

JH: There's the pedagogical question. To what extent is science fiction useful in getting young people interested in science? And that's something I, as an author, would back away from doing directly. It either works or it doesn't work, and I think it works best in terms of how good the story is rather than whether it is intended to spur interest. I think kids can spot that intent and it turns them away. I think the science element is something an author does if that is important to them, and I think that shows in the story, and I think that's what connects. If you can see yourself as a young reader, interested in these sorts of things and searching for that conversation. But same, if encouraging an interest in science is what's important to you as an author, that becomes the conversation between the author and the reader rather than the science itself.

Chapter 13

Ian Irvine

I do feel that scientists have a responsibility to communicate their scientific work to the general public. It has to be said that this is something that most scientists are not very good at, because they are unwilling or incapable or have never really learned how to communicate complicated ideas to a general audience in a simple, clear way.

—Ian Irvine

I had not met Ian prior to our interview, which was conducted via Skype a month or so after the World Con, where most of the other interviews were gathered. Ian is an Australian author who is primarily known for fantasy sagas, but his work also includes science fiction. A few elements of what could be called the Antipodean reality of working as an author might be noticeable in his comments. These reflect a physical isolation from the key publishing markets in the world and an inability to regularly attend many of the conferences and conventions where other professional science fiction authors gather. Ian is best known for his epic fantasy series such as *The View from the Mirror* series, which starts with *A Shadow on the Glass* (Irvine 1998).

ORIGIN STORY

II: I was always interested in science and I decided I wanted to be a research scientist or a practicing scientist, I suppose at about the age of thirteen or fourteen. I didn't have any interest in writing at the time or indeed for a long time after that, but I discovered early on in high school that if I wanted to be a scientist I had to at least do a reasonable degree in science and post-graduate

work so I decided that that was what I was going to do. I was mostly interested in geology and chemistry so my first degree is in geology and I worked on basically looking at climate change over the last few million years based on sediment cores from the bottom of the Tasman Sea.

I was also really interested in environmental issues from an early age. I was invited to do a PhD from the university of Sydney and I said I would only do one if I could study some environmentally related issue. They were just starting the big multidisciplinary research project on pollution in the Paramatta River, which empties into the outer part of Sydney Harbour. So I started working on that and ended up as something of an expert in contaminated sediments. Which is a considerable problem for every country in the world, every city, every river in every urbanized area has some. That's where I started and I still have my little consulting company some forty years on, doing that kind of work.

At university I started doing a bit of writing. I just loved books. In fact, when I finished high school my best subject was English, not any of the sciences. I'd always loved books and I started writing then, but I really didn't know anything about writing, so I chucked all that away. It was ten years later, actually more than ten years later, that I started to have this frustrated creative urge where I really wanted to write stories.

I had read a lot of science fiction and then I got into fantasy about halfway through uni and, I know a lot of other writers have had a similar experience with Tolkien because we had a convention about it once and all the writers said the same thing. "I read *Lord of the Rings* (Tolkien 1954) as an adult and said 'wow this is fantastic. Where can I get more?' " and there wasn't any more like that. There was fantasy out there, Fritz Lieber and *Conan the Barbarian* (Howard 1953), but nothing epic like *Lord of the Rings*. There were none of these huge stories on a vast canvas. So after reading most of the fantasy that was available in the world, which you could do in the mid-70s, I started creating my own fantasy world.

The catalyst for that, and perhaps the catalyst for my whole career in a way, was that I was reading the *Sword of Shannara* (Brooks 1977), by Terry Brooks, and it had this map in the front of it that was the start of it. And that was the sort of thing where the publisher had decided on the day before it went to print that they needed a map and told someone to quick, do a map. The map didn't seem to bear much relationship to the story. The vale was all wrong, etc. And I said to myself, I'm an earth scientist, I can do better than that. So, I started creating my fantasy world with the geography as the foundation. So, I had a map. I actually rotated New Zealand back up against Australia where it was 70 or 80 million years ago and started from there. So, I started creating a vast fantasy world and started producing maps the size of doors. So, once I had the map and the ecosystems and the trade routes and

stuff, I began thinking out thousands of years of history and all that kind of thing.

That was in the late 70s and then we had kids and renovated a crappy house in the suburbs of Sydney and all the usual. So it was another ten years before I actually had the time to start writing. By this time the urge that I had mentioned had built up to such a point that I had to try. After many false starts I should point out.

I tried planning and all that and it didn't seem to mean anything to me. All the stories just seemed made up. They didn't feel real. So eventually I said "bugger this" I'm going to start from the first page and just start writing. I started in September 1987 and I told myself that if I just wrote three pages a day, I could have the first draft of the story done by Christmas. I actually wrote it in manuscript, because I found it hard to compose on the keyboard at the time.

It was incredibly hard work and more than a few times I thought that it was stupid, but I got about a third of the way through and suddenly the story came to life for me and I thought "wow, this is what I want to do for the rest of my life." I finished the first draft about three days before Christmas.

Did a few more drafts before sending it out to publishers, which were all in the UK and US. No publishers in Australia were publishing fantasy. So, you'd send stuff off to a publisher and it would be six months or twelve months before you get a reply. I had a very encouraging response from Allen Unwin saying they weren't going to publish it, but they would like to see anything else you write. So I just kept writing. And now that I knew the story . . . now I could plan it. So then over the next couple of months I realized that it was going to be a quartet. So I did some fairly detailed plans which, of course, I didn't end up following.

So I kept sending the first book out and kept writing and this went on for four or five years, and then I, along with Sara Douglas and a couple of other Australian writers, like Grahme Hay, Martin Riddleton, got picked up by a publisher and suddenly fantasy by Australian writers was outselling a lot of the big name UK authors and suddenly all the publishers were interested. So, after a couple more false starts, I got it into Penguin and that was basically how I got started.

INTERACTIONS WITH SCIENTISTS

II: Well, basically they were the people I worked with for years, so . . . they're just people I work with. I set up my own consulting company in 1986, basically doing work related to investigation and clean-up of contaminated sediments. So I've worked as a scientist in a dozen countries and worked for the World Bank, lots of places. I'm currently working on a number of projects

in Australia where I'm working with scientists and other experts pretty much all the time.

COMPROMISES ON SCIENCE

II: I suppose there are some compromises. My natural tendency is to over-complicate things and over explain. To be honest, I don't write a lot about scientists. Most of my work is fantasy, and there's no science in the stories themselves, but clearly, going all the way back to that map when my background in science influences what I write from the imagery to everything else.

The only books I've written that have scientist in them are my three eco-thrillers. *The Human Rites Trilogy* (Irvine 2000) it's called. They're set in a world of catastrophic climate change and one of the ideas behind the stories is that the West Antarctic ice sheet has melted. This is based on pretty good science. We know it's unstable. It's melted a few times in the last few million years. In the book it's melting and it's raised sea level by five or six metres in a fairly short time and this has had a catastrophic effect on the global economy. If you think about it. All the cities, harbours, airports, good agricultural land, railways and such that are based right near sea level either have to be abandoned or protected. Either of those is monumentally expensive. So this has had a massive effect and also it has flooded out hundreds of millions of people. All of that is good solid science.

So this is the setting. And I've gotten to revise and update the science a couple times now with new editions.

I don't compromise the science, but I do have to work hard as a storyteller to reduce some of it into elements that are going to be comprehensible in the context of a story that's popular fiction. And these books are thrillers. They're not intended to be lecturing people about climate change, so the science has to be reduced.

THE TEACHING MOMENT

II: I'm quite interested in teaching. And I've written quite a few articles on most aspects of writing. Mostly from the story telling viewpoint, and commentaries about publishing, focused on what new authors need to know. I like to be able to share my knowledge with others and the publishing article does that. It basically answers all the questions I had when I first became a published writer. Publishers never tell you anything, so I laid it all out from royalties to process and everything else.

I have no ambitions to be a teacher or a university lecturer or anything like that, but I like teaching and I do quite a few school talks and mentor a number of writers.

BETWEEN SCIENCE AND SOCIETY

II: For me it's not a very strong link, but I do feel that scientists have a responsibility to communicate their scientific work to the general public. It has to be said that this is something that most scientists are not very good at, because they are unwilling or incapable or have never really learned how to communicate complicated ideas to a general audience in a simple, clear way. This is something that I've always been concerned about.

I don't go out giving public lectures or anything like that, but when I get the opportunity, I do try to convey scientific ideas to people, including research I've done in the past.

WHAT SHOULD I HAVE ASKED?

II: Probably. I suppose I'm in an interesting position in comparison to most of the people you're interviewing. There certainly are a number of science fiction writers with a scientific background, and many of them are actually working day to day as scientists, but I might be the only scientist that is first and foremost a fantasy author.

I'm interested in how people write science fiction if they're not scientists and how people write science fiction if they are scientists. That's not something I ever read an article about.

Chapter 14

Nancy Kress

I consider science fiction to be a rehearsal for possible futures. It's about possible impacts of technology.

—Nancy Kress

The interview was the first time I spoke to Nancy and, other than having read a few of her novels, I knew very little about her before we spoke, and I wasn't as familiar with her work as I thought I was. She won the Hugo for *Beggars in Spain* (Kress 1991), and her most recent novels are the Yesterday's Kin series, which opens with *Tomorrow's Kin* (Kress 2017).

ORIGIN STORY

NK: Mine is a very female version of the science fiction writer origin story. I didn't encounter science fiction until I was fifteen and for a very specific reason. I grew up in the 1950s in a small town and the library had a girl's section and a boy's section and all the science fiction was in the boy's section, and being a goody-goody, I never went over there. The fantasy was in the girl's section so I read Andrew Lang's *Red Fairy Book* (Lang 1890) and all the rest of those, but I never saw any science fiction.

Then when I was fourteen I had my first serious boyfriend and he was studying to be a concert pianist. I would go over to his house and hang adoringly over the piano while he practiced. Well I'm tone deaf, and a little impatient. I can hang adoringly for about ten minutes and then I started pulling books off the shelves. They were his father's books and among them, one of the first things I pulled down was Arthur C. Clarke's *Childhood's End*

(Clarke 1953). Three pages in and I was hooked. I was in love and not with the concert pianist. This was a canvas larger than any I had found before and I was enraptured, but I didn't expect to write it. I grew up in a very conservative Italian-American family and I expected to become, and became, a fourth-grade teacher.

I taught for four years, and then I got married and it was when I was pregnant with my second child that I started writing. We lived way out in the country, there was only one car, which my then husband took to work, and there were no other women my age anywhere nearby. I had a toddler running around, a difficult pregnancy and I was going nuts. So, I started writing for something to do that involved words of more than one syllable, and I didn't take it seriously for quite a number of years. It just wasn't on my radar.

My formal education includes an MA in English and an MA in elementary education.

COMPROMISES ON SCIENCE

NK: It's complicated, because there's more than one sub-genre of science fiction. I have written stories in which science is mostly a metaphor. For instance, I had a story called *people like us*. Basically, it's about the class system in the United States. There's an alien in it but I make no attempt to furnish this alien with a believable background, planet, physiology, biology or anything. He's there as a symbol. That's one kind of science fiction.

I also, however, write hard SF, or at least, very high viscosity SF, and in that I do try to get the details as right as I can. I'm not trained as a scientist, but I still do the research. This requires a tremendous amount of research. Which I do. Online, libraries, and by asking scientists.

INTERACTIONS WITH SCIENTISTS

NK: My late husband was a physicist and through him I knew a great deal about how science works, and I met a great number of scientists and that also informs my fiction.

I'm a science groupie, and I do interact with them whenever I get the chance. And I'm included with them on panels at conferences. Two weeks ago I was on a panel at Geek Wire Summit, which is the Pacific Northwest's Premier conference for engineers and techies, and I was on a panel with a former astronaut, and I manoeuvred things so I could sit next to him at lunch, so I got to ask him about all kinds of things I was interested in.

When I'm around scientists it's the only time I ever feel nervous about speaking in public because they actually know things, but I make it up. I also listen and try to learn as much as I can, because I say, I'm a science groupie. It was never the rock stars. Even when I was young it was the scientists.

THE TEACHING MOMENT

NK: I teach all the time. I teach science fiction writing. Mostly at summer conferences but occasionally I'll pick up a course at a local arts centre.

A couple of things come to mind. One is that great many aspiring science fiction writers don't really have as much respect for science as I think they ought to. They'll throw absolutely anything in, and this bothers me because I will tell them "your automatic default position, for instance, on clones is that they are going to be evil. Why? It's delayed twinning. It's a twin born of your exact same DNA but born 24 years later. Even though that doesn't mean you will turn out exactly the same, it's still genetically a twin. So why would you assume it's going to be malevolent or a monstrosity or anything else that isn't associated with normal clones?" They don't think about these things and there's a strong reason they don't think of things like this, and that's because twins isn't the way that science fiction has presented cloning in almost all of the movies.

I really think, and this is where I wanted to go with this. It bothers me that science fiction, including my own, is usually focused on negative outcomes of scientific and technological advances. There's a reason, of course, why this is so. It makes a better story. You have to have conflict in a story. Fiction is about stuff that gets screwed up, but if you focus on what gets screwed up by technological and scientific advances, by necessity, you're presenting them far more negatively than they actually are.

A specific example. I am very much in favour of the genetic engineering of crops. I think that if we don't do this, we are going to be in tremendous trouble in the near future. It's already happening in the third world. There are crops that are suppressed from fear, from trade protectionism, that could benefit people who haven't got a very large margin of calories to live on. If climate change continues, and or the population continues to grow to the projected 9 billion, we'll be in even more trouble. But when we present genetic engineering in science fiction, very often we do it in a negative way because we're looking for the negative elements that are going to drive the conflict of the story. And this only ends up contributing to public perceptions of technological advances as dangerous, negative or immoral.

This does bother me. I've been thinking about this a lot. I wrote my most famous novel, *Beggars in Spain* (Kress 1991), which is about people

genetically engineered to never need to sleep, partly in order to have a genetic change to the human genome that involved no negative downsides. These people are not monsters, they don't pay for it later by getting cancer or any of the other things that science fiction writers usually build into genetic engineering stories. In fact, all they get is gains, but then I had no story. So what I had to do, in order to bring conflict was to show the social reactions to other people to them as the human race bifurcates into those who sleep and those who do not. Because those that don't need to sleep get another eight hours of life every day.

I actually wrote this story out of jealousy. I need a lot of sleep.

I wanted an example of a technological advance that didn't have a downside, but I didn't have a story until I found some other route to bring conflict in. We have to have the conflict, but in creating it we have to avoid creating a skewed picture of science and technology.

BETWEEN SCIENCE AND SOCIETY

NK: This is the arrow. There's pure science, which usually does not interest readers at all. There are very few readers who actually care if string theory is true or not. It doesn't impact their lives in any way. It's when science gives rise to technology that it then impacts society. So it's science, to technology, then to society. Where science fiction writers come in is on the technology part. Very few of us include any actual pure science in our books because the reading audience for that would be very small. It's when it translates into technology that affects society that we come in.

I consider science fiction in those terms to a rehearsal for possible futures. It's about possible impacts of technology. In other words, not predictive, which we often get told it's supposed to be, which is blatantly not true, but rehearsals for possible futures some of which are cautionary tales. "If this goes on, then . . ." In fact, I think too many of them are cautionary tales. Some of them are "This is something that is going to happen and this is how we might handle it." Too few of those.

I think science fiction has a contribution to make in this respect. Rehearsing how this might go down, whatever it might be.

WHAT SHOULD I HAVE ASKED?

NK: You should be asking about movies. The number of people that are reached by books is small compared to the number of people that are reached by science fiction movies. I think science fiction movies in general do a

terrible job of conveying science to the viewers. In the first place, they don't go for anything that consistently makes sense. I don't know if you saw the movie *Moon* (Jones 2009), where they're mining on the moon. Instead of sending three guys up with hazard pay, which is exactly what they would do . . . And especially since we find out halfway through the movie that pods can go back and forth, because they bring up the corporate bigwigs, so instead of doing that, they have this elaborate thing with clones underground and jammers and all the rest. It's just ridiculous. But worse, it gives the idea that just because science is very complicated, then the way you have to use it is complicated, and that it will fall into evil hands and be used for evil purposes.

Sometimes the movies don't even try to make sense. *Interstellar* (Nolan 2014), which I really, really hated, posits after starting out very carefully, that only things that can escape a black hole are Hawking radiation and Matthew McConaughey. That does not make any sense in any way whatsoever. If they could communicate back with us in that way, why not just tell us which of the three planets were viable in the first place?

It seems to be more about blowing things up in science fiction movies than the actual exploration, or rehearsals for the future, of what written science fiction is.

The only science fiction movie I've actually liked recently was *Her* (Jonze 2013), because I can see why a character that is a little marginal socially could actually fall in love with a talking operating system. Some people are very suggestible. I know I'm one of them. If I had a computer that could really talk to me, I'm sure that I'd have an anthropomorphic relationship with it. Nothing blew up in that movie and it presented the science in a believable way, in a believable rehearsal of a future.

Chapter 15

Jack McDevitt

I like to think that I'm not really writing about science. I am writing about people who have unusual experiences as a result of scientific breakthroughs and technology. To do that, you have to keep the science valid.

—Jack McDevitt

Jack and I had not met or corresponded before the interview, and I knew almost nothing about him beyond his fiction. He's best known for a couple of series that reflect his naval experiences. Both feature pilots and one is about working for an artefact hunter in a future distant enough for there to be human artefacts to be found out there, *A Talent for War* (McDevitt 1989); and another about a starship pilot who is working for a science academy, *The Engines of God* (McDevitt 1994).

ORIGIN STORY

JM: I suppose it is always curious how you get into something like this. When I was four years old my father was taking me to the movies on Friday evenings. I grew up in Philadelphia and I don't really remember any of the movies we saw. It would have been about 1940 or so. But they were running a *Flash Gordon* serial (Stephani 1936) and I got caught up with Flash Gordon right away. I loved that rocket ship that he had. They travelled to Mars in it. They travelled to other made up planets. I didn't notice at the time, but the rocket ship had no airlock, and it had no washroom. So, I don't know how they managed to get to Mars in this thing, but I didn't notice then. I loved this rocket ship and I can still remember coming out of the theatre one night,

annoyed, and I asked my father how come they had that great rocket ship and they don't do anything with it? They just get into fights with this guy who looked like my uncle George. I thought it was a horrible waste of great technology.

That, by the way, has impacted me to this day. I don't care for science fiction that's just about us fighting the bad guys or that sort of thing.

Another part of that story that's kind of amusing is that when we came out, I still remember that there was a full moon and I asked my father if we were ever going to go to the moon. He didn't think it was ever going to happen because rockets had to have something to push against in space and you really can't make that ever work.

That was my first experience and I never recovered from it. I became permanently connected to science fiction. It got me interested in astronomy. I was able to get a hold of some of the pulp science fiction magazines that were available at that time and I discovered Ray Bradbury a few years later and I was just hooked for life.

The biggest thing about my educational background is that if you asked me how I became interested in writing I would tell you that I don't know. I do know that I was interested in writing from early on. When I was seven or eight years old, I tried writing a Batman novel. I tried a science fiction novel very early. The topic of it was the canals of Mars, which will tell you everything you need to know. I went to a Catholic high school and when I got there I managed to get a spot on the newspaper and I did a column for about three years at the high school.

Then I went to LaSalle College, LaSalle University now, I majored in English, because I had decided by then that I wanted to be a professional writer and I also became a columnist on the LaSalle newspaper. I was convinced I was going to be a writer. I sent out a couple of early stories when I was about sixteen or seventeen to a couple of professional magazines and one of them even wrote back encouragingly. I was annoyed because they didn't buy the story.

What happened when I hit LaSalle, they had a freshman short story contest and I submitted a science fiction story to that and it won. They printed the thing in the college's literary magazine and I saw my name in print and I thought I was on my way. Then, shortly after that, I read *David Copperfield* by Charles Dickens (Dickens 1849), and I realized that I was never going to be able to compete with this guy. He was too good. I couldn't get anywhere near that kind of style. So I gave up and other than my newspaper column, I did not write anything more for twenty-five years. Not another word.

I'm not sure what the lesson in there is, but the only reason I started writing professionally was because I think I talked about, periodically, or maybe a lot, and my wife encouraged me to try it. So I wrote a short story. It got rejected the first couple of times I sent it out. A friend made some comments, I sent it

out again, rejected again and I was about to give up. Then Maureen (my wife) found a copy of *Twilight Zone Magazine* and I ended up sending it to them and they bought it. It shocked me, absolutely shocked me, but after that, there was no way I was going to stop.

During those twenty-five years of not writing I was a naval officer, I spent ten years as an English teacher, became a U.S. Customs inspector and was with them for twenty some years and by the time I retired I was writing full time.

COMPROMISES ON SCIENCE

JM: I'm not aware of any real compromises that I've made in the writing. I spend a lot of my time talking to friends of mine who are scientists.

One of the wonderful things I have discovered is that I can just call anyone. I can look up a scientist on the internet, call them and ask an off the wall question and most of the time they're happy to have a conversation. I remember with an astronomer early in my career: I asked him "when you look at a star, what can you see in that light that might tell you if it was an artificial construct?" The scientist got all excited by the idea and asked to think on it and then he called me back later and we talked about it. It's amazing how excited they get with stuff like that.

I try to keep the science legitimate, keep the scientists legitimate. I like to think that I'm not really writing about science. I am writing about people who have unusual experiences as a result of scientific breakthroughs and technology. To do that, you have to keep the science valid. You have to keep it close to the way scientists actually work and what's valid about the science so that when I screw it up, it's a matter of simply missing something rather than making a compromise.

The reason that is so important is that what a writer is trying to do is to not simply tell a story. A writer is trying to create an experience. If you're one of my readers, I want you out there on the edge of that cliff when the young woman says "Sorry I know it's been good but it's over," and she turns away and leaves the main character in tears. I want you crying too. I literally want tears in your eyes. And if I get the science wrong, or the spellings wrong or anything else wrong, it reminds you that you're in an armchair. So, it is absolutely essential that I don't do that.

INTERACTIONS WITH SCIENTISTS

JM: There is one thing I want to add. I've been doing this now for thirty years and virtually all of the scientists I've talked to I've called out of the blue and I

have yet to have anybody turn me away. Nobody. It's really been incredible. When I first started, I thought I would get a lot of them saying they didn't have time or they have better things to do but I have never run into that.

THE TEACHING MOMENT

JM: Not really sure where to go with that, but I tell you one thing that really mattered and I think a lot of writers might tell you the same thing, it's about when a publisher bought that first story. The first story that went, the title of it was the "Emerson Effect" (McDevitt 1981), and it was a story about a guy that worked in a post office and was in love with the woman who worked at the other counter and was afraid to make a move because he was afraid of being rejected. And then one day a letter came in and it had been mailed 125 years ago by Ralph Waldo Emerson and it had gotten lost and now it shows up. The content of the letter, I took from Emerson's writings but I included the line, "if you can learn to believe in yourself you can do almost anything." So that encourages him to make his move and of course the story goes from there.

At the time I was writing it I didn't realize that I was reporting on myself. That was me in the story. I didn't want to fail so my response was not to try. So I came away from it with the fact that I had noticed it while teaching, but had never applied it to myself. Most human beings I have run into are smarter than they realize. What happens to a lot of us is that we have authority figures that we grew up with who mostly spend their time showing us what we've done wrong. Don't touch it. Don't break it. And that kind of scares us.

When I was in the navy I was, among other things, a communications specialist and I remember my father after I got home going to a party for a cousin that was getting married and somebody had given her an FM radio. I was playing around with it and my father came over and said, "Don't touch it, you'll break it." I was a communications guy! I think I could handle an FM radio.

I think that after a while, when you grow up with that, and with teachers doing that . . . The majority of teachers, in my experience, what they do when, say you write an essay, is they show you all the stuff you get wrong. And after a while you start to buy into it. You begin to think that you're really not as smart as everyone else. I got in the habit when I was teaching of intentionally trying not to do that. I'd look for the good sentences, and that sort of thing, so I could say "give me more like this." That worked much better than always saying what was wrong. I'm pretty sure that that is the truth of teaching. I know that I became a much better writer once I became sure that I could write, but I couldn't do that until I had sold that one story.

BETWEEN SCIENCE AND SOCIETY

JM: I don't think of myself in those terms. I think of myself as an entertainer, but I do get a fair number of emails and other communications from physicists and astronomers and other people telling me how much science fiction has meant to them. That had it not been for science fiction they would have never become involved in science. Some of them even tell me that it's my work that's done it. That's not that often, but it does happen and I do hear the more general comment a lot. That they are scientists because of science fiction.

So, I feel that I'm there to help a little bit, and if something I write inspires someone I'm thrilled, but I don't want to take credit for any of that. I really don't think of myself as trying to consciously bridge that gap or fill that space.

WHAT SHOULD I HAVE ASKED?

JM: How can I tell when a piece of fiction works?

The answer is: when I enjoy writing it. If I'm having trouble writing something, if I'm struggling with it, then it's not going to work for the reader either. I need stuff where I can call my wife in and read parts and feel excited about it and watch her react to it. If I can do that, then I know I've got something.

Chapter 16

Rebecca Moesta

Science is partly PR, otherwise you're not going to get people to follow you into the science or to care about what you are doing.

—Rebecca Moesta

As part of an earlier effort to bring an adaptation of one of Rebecca's novels to Avalon Studios, we had previously corresponded and were acquainted in that way well before the interviews. Those conversations, however, were purely focused on the stories and the lengthy, and quite frankly insane, process of initiating the production of a film, and I did not know much at all about Rebecca as a person or as an author. Rebecca is primarily known for her novels for young readers, particularly those set in the *Star Wars* universe (Moesta 1997).

ORIGIN STORY

RM: I remember watching science fiction with my father, starting with the very first episode of *Star Trek* (Roddenberry 1966). I was kind of nerd and I thought that the scientists like Mr. Spock were the coolest part of the show. I didn't think Kirk was as cool as the other ones. I thought they were more knowledgeable, and I liked the knowledge and intelligence aspect of it. I always kind of viewed myself as related to science, starting when I was nine years old.

To me the scientists are the problem solvers, they are the ones that find out what's going on and fix what's wrong. So, I always saw the scientists in movies, regardless of whether they were the bit parts or the main parts, I

thought of them as them as the good guys. Sometimes they are written as the bad guys, but I go for books and movies where the scientists are the good guys. The enquiring mind as hero.

COMPROMISES ON SCIENCE

RM: I think I tend to approach characters the same whether they are scientists or not. I'm sure there are some general characteristics that sometimes go with a scientists but I've known so many different scientists that I don't see them as unidimensional. In fact, one of the things I like to do is challenge stereotypes and kind of mix things up so that you get a variety that feels real. I don't have the guys be the ones good at math and science and the girls be the ones that are good at English and humanities or anything stupid like that.

INTERACTIONS WITH SCIENTISTS

RM: Probably at Cal Tech. I didn't get a science degree myself. My MA is in business administration, but I interacted constantly with the professors and grad students in the sciences. I read scientific papers for entertainment. My sisters and mother were all nurses so there was a lot of medical background that just seemed like normal everyday things. And I enjoyed just casually doing research into scientific and medical topics. Just for the fun of it.

I was married to a nuclear physicist for ten years. So, I suppose you'd call that interacting with a scientist.

THE TEACHING MOMENT

RM: Telling a story is the first thing, because if you don't have that first, I don't think anybody will stick around for a message you want to share. I'm always trying to make science seem interesting and approachable and something appealing. For a while, I taught remedial math, to people in the army. I was a master teacher for Big Ben Community College which had a contract with the military to teach various remedial things and then I graduated to teaching business courses to NCOs. But I spent about two years just teaching basic math to people who had forgotten it and thought that it was scary and intimidating. Almost always what I noticed was that they had had bad teachers. They probably used math all the time but didn't realize that they were already doing math problems in their heads, but never realized what relationship something like an intuitive estimate actually had to math. So, when I

could draw the line for people and say, look you're doing this all the time already, then they'd be excited and the fear would go away.

I really liked opening eyes that way. I think sometimes people find science and math intimidating and they get negative feedback because they think they aren't good at it so they feel bad about themselves and so they avoid it. So it's about breaking down the barrier. And a lot of the people who have that attitude of avoiding science often don't realize what they have because of science and because of the work of all the scientists who have come before us. Our whole society is based upon scientific discovery.

The teaching moments themselves are actually usually part of my studying. When I do a book like *Star Challengers* (Rogers, Moesta, and Anderson 2014), that has so much science in it, I have to study it. I find all kinds of things in that that I didn't know, like the fact that astronauts wear diapers, or if the moon has 1/6th the gravity of the Earth what does that mean about what you can see or the atmosphere? The way I've seen that interpreted in terms of movies or stories that aren't very accurate . . . it's hilarious how they think things will work on the moon. I had to study and all of these things that I read and discovered, they all can't go in there, so I come back to the good story.

It's the details that are both accurate and good for the story, things that are interesting, those are the things that go in. A day that's two weeks long, that's interesting. How the temperature drops as soon as the light is gone, that's interesting. Those are the things that grab my imagination and those are the things that come across in a story. Those are things that I try to work in.

The *Star Challengers* books were actually based on teaching. They were supposed to be a combination of science and fiction that made science interesting and opened that up to kids who might not already see it as something interesting or a career to pursue. But for the most part, when I'm writing, it's not about teaching. It's about stories and characters. As I get into writing, I usually see moments . . . maybe the story has a lot about learning to trust your own instincts, so then I put a little more of that in there, that sort of thing. So, I find I have a motif and I then strengthen it more than I try to teach.

BETWEEN SCIENCE AND SOCIETY

RM: Scientists are so focused on the precise thing they're studying that when they try to share that with somebody else they don't back up and show people the big picture. A lot of times they're focused on minutia instead of the big picture and showing people the beauty of science. I'm thinking about this one instance where they were making a satellite and there were budget cuts so what the engineers did was went and took all the cameras off the satellite. Kevin (Anderson) and I just went into fits and said "No! How do you expect

the public to want to fund science if they can never see the results of the science? You have to show them what you are learning.” So science is partly PR, otherwise you’re not going to get people to follow you into the science or to care about what you are doing.

WHAT SHOULD I HAVE ASKED?

RM: No, not that I can think of, but maybe I could just say that my philosophy is that science should be enriching. Unless it’s integrated into life in a way that kids can understand it. They need to understand how it integrates into everything or you’re going to lose them.

All the best science happens because somebody asked themselves “what if?” or “could I do this?” So, if you can pass on kids the fact that science is very imaginative, and interesting and fun, then they’ll be next generation of people doing amazing things with science.

Chapter 17

Simon Morden

That's the tension between the playfulness of art and the rigor of science, and being a science fiction writer who is also a scientist, I sit somewhere in the middle between these opposing forces. It's just a question of trying to do justice to both at the same time.

—Simon Morden

Over the previous few years Simon and I had tossed a few casual comments back and forth over social media, but prior to the interviews I knew very little about him other than the fact that we share a similar sense of humor.

Simon is best known for his postapocalyptic London cyberpunk novels that start with *Equations of Life* (Morden 2011b).

ORIGIN STORY

SM: As a kid, I think I was about three, there was a point in the late 1960s where Cornflakes was giving away little models of the lunar lander and Apollo and the Saturn 5 and stuff like that. These things, and the idea that you could go out into space and land on the moon was just endlessly fascinating. It didn't really stop. So I've always been interested in basically breaking stuff to find out how it works. Skipping over the problems that created . . . as a kid maths excited me in the sense that you could get a string of numbers and it would tell you something about the way the universe worked. You could use those numbers and build stuff with it and it would change your environment. It was that sort of thing.

I can't remember the very first time I discovered science fiction. We had a TV quite early on, I don't know if you remember but they were kind of hard to get back in the 60s, and we always had *Dr. Who* (Newman, Webber, and Wilson 1963) on, but that wasn't really science fiction. The programs that really got me were the actual science programs, like *Tomorrow's World and Horizon* and things like that. I would be glued to them. I distinctly remember moving to a new school and they discovered there that I could not only read, but read to very advanced levels. It put me sort of out of the range of all the usual school reading books, so they said to me, just go and choose a book at the school library. I picked one of Harry Harrison's junior books, *Spaceship Medic* (Harrison 1970). It had a picture of an astronaut climbing in through a gash in the hull and I was fascinated by the idea that someone was using science to tell stories and that was it, essentially.

I have, more recently, read fiction that isn't science fiction and fantasy because I'm trying to branch out, but it's difficult. That's the daft thing. There's a world of literature out there and I don't want anything to do with most of it. My Mrs. waves these books at me and says this is really good, you have to read this, and they're mostly well written, but mostly they don't have a plot.

So, back to the story, after *Spaceship Medic* I started reading everything with a spaceship on the cover. Finished off everything in the school library in no time, and then the village library wasn't that big, so I went through it pretty quick. My salvation came from my mum working with a charity that held jumble sales. Part of the jumble sales was the bookstall, and my mum would always volunteer to sort the books for the stall, and she would take out all the ones with spaceships on the cover, buy them, and bring them home to me. Sometimes these boxes were really quite big. Inevitably, there was a whole pile of rubbish in there, but there were also some really good books in there. That was where I first encountered Arthur Clarke, Robert Silverberg, Isaac Asimov and stuff like that, and along with those there were fantasy books as well. That went on for eight to ten years.

I went to university, and the moment I realized that I could write my own stories came after I became involved in *Dungeons and Dragons*. There came a point where I realized that the person on the other side of the table from you is writing the story in which you are a character. That led me to wonder what it would be like to sit over there and direct these characters through a story that I created. So, I gave it a go, and then I started to get better, and then I started to get frustrated that when you write, the characters you are trying to direct through your carefully constructed story don't do what you want them to do. So, I'm holding these two things in tension. I've got all the books I've ever read in my head, and I've got this creative urge

to write a story, but it took a long time to eventually realize that it's two sides to the same problem. You've got stories you want to tell and stories you want to read.

Stephen Lawhead wrote a series of books retelling the stories of King Arthur, the Pendragon Cycle (Lawhead 1987), and when the fourth book came out, I was so disappointed with it, that I thought, I am going to write the sequel that he hasn't, and that was it. That was when it started. I was so disappointed that it wasn't the story that I wanted it to be, that I am going to do it myself. I had no idea what I was doing. I knew how to structure the story, but getting from A to B was a mystery. All I knew was what was going to happen next, so I just got it started.

I got it published and it's not rubbish, which was quite an accomplishment for a first go. From then I thought, if it's not rubbish, let's give it another go. So I started by pitching what ended up to be the Metrozone Books (Morden 2011b) to a bunch of publishers, and that simply didn't work. I had written the first one and it needed a lot of work, and in the process of revising and revising and revising it, I started writing something else. That became *The Lost Art* (Morden 2007). I was about four chapters into that, and I was lucky enough to have an agent at that point so I sent them to him and a short time later he called and said he thought he had a buyer, but it wasn't for the Metrozone novel, it was for the new, unfinished one. The publisher wanted the unfinished book, but he also wanted to meet me to make sure I wasn't an idiot. I could do that. It wasn't easy, but I convinced him I wasn't an idiot and that was the real starting point.

That was *The Lost Art*, my first big publisher novel, but we couldn't get him to publish anything else I had written and that led to the relationship with Orbit. I had *Equations of Life* (Morden 2011b) rewritten, and half of *Theories of Flight* (Morden 2011c) written and hadn't started on *Degrees of Freedom* (Morden 2011a) yet, and Orbit wanted them out in eight months. I worked like a dog on that. I think my family vaguely remembered what I looked like when I finished. This is the daft thing, it didn't feel like work until I hit those days where I'd been at it for ten hours and I still had the laundry and the shopping and the cooking and the gardening, and you suddenly realize that yes you've written 2,000 words today but the house is falling down.

As far as education, I went to university and did a degree in geology. Then I started doing a masters in geophysics and someone on a PhD had to drop out and the lecturer in charge of that said that if they didn't have someone in that space they would lose the funding for it. So I said, you know what, I can do that.

It was an interesting subject. We had these meteorites and we had to figure out how they were formed without destroying them. So we examined the

magnetic properties to find out whether the meteorite parent body had formed from cold accretion—in which case the magnetic orientations of the original grains would be conserved and they would be pointing in all kinds of different directions. Alternatively, they could form hot, and then the meteorite would have a singular magnetic orientation.

So, three years of going through various classes of meteorites to determine how they were formed, and I said, “let’s go for it.” I was doing the masters course anyway, so it wasn’t actually adding all that much time wise and if I hated it, I could still go back to the masters, but I loved it. I was suddenly in my element. I was reading scientific papers and working out what they meant. I was doing experiments all day. I was talking to hugely important people at NASA and the British Museum and stuff like that. I was being treated as a fellow researcher and I loved it. I thought it was brilliant.

So, I completed a PhD in geophysics in just under three years, and then a post-doc on the back of that, and then the utter catastrophe. My supervisor retired and I was too junior to have a position of my own, so the funding vanished and that was it. I did try everything I could think of to stay in academia, but it just wasn’t happening, so I had to go out and get a proper job.

That was a shame, but nothing is ever wasted. Many, many years later, when my kids went to primary school, I volunteered to help with the reading and the maths and stuff like that. I did have a reasonable grasp on primary school maths and reading. I talked to the head teacher and she said that they could probably manage something slightly better than that. I suddenly found myself employed part time as a teaching assistant. So, I was thrown in the deep end at the top end of primary school, but I could still manage the maths, so it was good. I ended up teaching design technology for four or five years, just because I could.

So, I’d work with the science teacher and I would basically do the engineering part of it. We would build stuff, rockets, aeroplanes, cars, bridges, basically applying all the physical principles. We would just make stuff so they knew how things worked and how things went together.

Then came the fateful day when the science teacher came in and slapped a piece of paper on the desk and asked “do you think we could do this?” and it was the Rolls Royce Science Prize for schools. I said, “Yeah, give it a shot. What do you think we could make?” He thought renewable energy would be good, so we ended up making a perspex wind tunnel, so you could actually see everything in it during the experiments and we had industrial air conditioning fans on the back. I was in charge of the instrumentation so we could actually computerize all the readings and stuff like that.

So we had this full-fledged wind turbine testing thing and we won. This little primary school at the back end of nowhere beat secondary schools and elite colleges and all that.

INTERACTIONS WITH SCIENTISTS

SM: I was at Eastercon, which is the big UK science fiction convention. So, I'm talking with this materials scientist from the University of Cambridge and he's working on conducting and semiconducting polymers. I happened to mention grapheme and he crossed himself and swore at me because that's not what he does. He does actual plastics. So it's a question of trying to dope long-chain polymers with various metals in order to get them to conduct. Then you can integrate circuits into plastics. The possibilities are frankly endless. We were in the pub at the time and we ignored the rest of the room and we just talked for it must have been two or three hours. We were just chatting. And that's the thing, if you can explain your science to another scientist, who by the very nature of science is intensely specialized, then you really have a handle on science.

I was recently approached by another academic working in infomatics and he's trying to match up short story writers with scientists to collaborate and critique each other's work through the medium of short stories. So, we will have a theme of short stories, such as augmented life, and the short story writers will write a story about how they think cybernetics or some other form of augmented life will affect society. Then the scientists will explore if that's possible. Then both the story and the comments are published in an anthology.

COMPROMISES ON SCIENCE

SM: No. I'll be brutally honest about this. I try, my very, very hardest, to get the science absolutely right, without ever compromising the science itself. There have been points where I have been writing and I've gotten to the point where I will simply tear up a section of the book because I realize that I've gotten the science wrong. And I'll have to go back and rethink the whole thing and do it better. It's not a question of pride, I don't think. I think it's more a question of humility. There are physical principles by which the world works and I know, because they have written to me, that I've got people at JPL (Jet Propulsion Laboratory) reading my books, and they are going to be so disappointed with me if I skip a bit of science. They're my core readership, but they really aren't. I'm pretty sure that my core readership wouldn't really mind if I skipped the difficult bits of science and just got on with the story. But those people who would be really disappointed in me if I did that, are those people who are the scientists themselves. I feel like I owe it to scientists everywhere to actually do the science.

I finished a story recently, a novella, about a spaceship that is travelling at fraction below the speed of light. I know that a lot of people say that you're

allowed one piece of hand waiving in any given story. So my bit of hand waiving is that the ramjet shield will protect it against the relativistic particles that it uses as fuel, but everything else in the story, all the special relativity is, as far as I can make it, absolutely spot on. So there is a point where the spaceship has to slow down in order to match courses with something that is slowly dropping behind. He can't turn around, because the shielding and gathering field only faces forward. If he turned around the ship would be toast.

So I got to his point in the middle of the story and I thought, I've got to slow down a spaceship that's moving one kilometre a second slower than the speed of light, without turning it around, how do I do this. And I thought, if I cannot come up with a way of slowing the thing down without turning it around, I am simply going to have to abandon this story.

This is the sort of thing that I love doing.

THE TEACHING MOMENT

SM: Okay, so I'm going to talk about being a judge for the Arthur C. Clarke award. It was probably about October that I got the first parcel of books to read and judge. It was six or seven hardbacks and I thought great, free books, grabbed one and started reading it. And then the next day I got another parcel of books, and then another and by the end of the week I had about thirty books and by the end of the month that was sixty.

I had to come up with a short list of six by the first week of January and I had sixty books to read in two months, which became eighty. So, every spare moment I had was spent reading these books. You could argue that it was ridiculous, but you read these things, which the publishers think are the year's best science fiction books that they've published, and you get forty or fifty pages in and you start wondering if it has engaged you enough to risk reading on and miss out on the chance to read one of the other books in the stack. That was enlightening for me.

Normally, what I used to do, I would read a book and no matter how good or bad it was I would always finish a book. But up against that enormous time pressure, it was the first time I realized that if I have not, in my own writing, engaged the reader in those first fifty pages, I have probably lost them. For most people, life is too short to waste on a book that they aren't enjoying, so even if the rest of the book is absolutely rubbish, gotta make sure those opening forty or fifty pages is brilliant.

This was spot on, because when we got to the shortlisting meeting, we had all chosen basically the same books out of that stack. Reaching the short list of six only took an hour.

BETWEEN SCIENCE AND SOCIETY

SM: You end up wearing two hats simultaneously. No matter how long ago it was that I did big science, I never really lost the interest or the willingness to explain and encourage other people about science. The degree of scientific illiteracy in society as a whole both offends and depresses me in equal measure. That's not just a function of hanging out with smart people who enjoy talking about science. It's a function of knowing that if people knew more about science then they would make better decisions.

So part of me wants to be the educator. Part of me wants to say that this piece of science is important because of this or that, but the other part of me is the storyteller where I am telling a story about people and I don't want there to have to be a learning point in the story. I don't want a lesson on learn this science or die a horrible death. There doesn't even have to be a moral to the story. I don't want the story to be telling you something like that even if it is about something like that.

So those are the tensions.

What I tend to do, is when I talk at conventions and things like that, I stick pretty solidly in the "I am teaching you mode." But when I'm in story telling mode, that goes away. In order to create art, you have to be utterly fearless. If you want to bend and break the rules, then you just go off and do it. There cannot be a teaching reason if you want to be able to do that. That's the tension between the playfulness of art and the rigor of science, and being a science fiction writer who is also a scientist, I sit somewhere in the middle between these opposing forces. It's just a question of trying to do justice to both at the same time.

WHAT SHOULD I HAVE ASKED?

SM: One of the questions that often comes up when writers are talking to each other is the perennial imposter syndrome. When we are out of earshot of publishers and readers it's always a question of "have they found you out yet?" "Do they realize you're an untalented hack or do you still have them fooled?" And we just sit around the table and we cannot quite believe that people pay us to make shit up.

People always ask us, "how do I become a writer?" And the answer is always, "Put your backside in a chair and start writing." Because without that action, there can be no words. The unspoken question is "how much hubris do you need to be a writer?" That's probably the question that I don't get asked enough, and the answer to that is "All of it."

My first effort at novel writing was simply because I was so disappointed by another writer and I just assumed that I could do better. How much hubris does that take? I don't think I'm that sort of person, but as a writer you have to take on that hubristic mantle of "You have disappointed me for the last time! I will show you how it should be done!" And that is a massive . . . you just gather that belief up like a giant bean bag and flop your arse in it and go.

Chapter 18

Larry Niven

I think that both scientists and people in general should know that they live in a world generated by science and they should know how it works.

—Larry Niven

I had met Larry at several conventions prior to the interview, but we had never shared more than a passing comment or two back and forth. However, it has always been a point of pride that Larry recognized the name on my nametag and knew of the first novel I had written. Aside from my mother, who only pretends to like the book, Larry may be the only one.

From those earlier meetings I knew that Larry is a very quiet and unassuming man. In fact, many of his fans have been known to walk right past him at science fiction conventions without having any clue that they just walked past a grand master. Larry was the first author I interviewed for this project, and he must be credited for suggesting that I reword my closing prompt to simply ask him what question I forgot to ask. That turned out to be one of the most popular questions with the writers interviewed.

It was quite obvious that Larry did not feel comfortable talking about himself but it was also clear that he liked the idea of this project and he was intent on helping out. The result is a rather brief set of responses and a short, but still interesting, interview.

Larry is a grand master of science fiction and is known for *Ringworld* (Niven 1970) as well as countless other works.

ORIGIN STORY

LN: I remember when my nurse, I guess you'd call her a sitter or a nanny these days, was reading to me as a small boy, she read the *Water Babies*

(Kingsley 1863). I picked up a copy of that decades later and I found it more political than I could have ever imagined. Then there was the OZ books, the *Wizard of Oz* (Baum 1900) and all the others. I read them all over and over again until my parents got tired of them and locked them up. Those did have an influence on me. The plot lines for the *Wizard of Oz* fit *Ringworld* (Niven 1970) very well, with the Wizard behind the curtain and the journey. Several critics have noticed that connection to OZ, but what they haven't noticed is that the whole *Ringworld* series was actually written to follow the *Candide* (Voltaire 1759).

I started really reading at the age of ten or twelve and onward. Heinlein was my first science fiction author, *Rocket Ship Galileo* (Heinlein 1947).

Formal education includes a BA in mathematics with a minor in psychology.

COMPROMISES ON SCIENCE

LN: I pretty much know what a scientist does. They're all great conversation-ists and really open about how things work. There are a lot of scientists who are eager to talk to science fiction writers and those are the ones I talk to a lot and I think those are the kinds of people my scientists as characters represent. There are a lot of scientists who aren't all that interested in talking to science fiction writers, so I wouldn't really know if I'm getting them right or not.

When I write fantasy, I'm just having fun, but when I write science fiction, most of all, I try to get the science right. I don't want to be caught in that silly space opera that isn't really science fiction and nothing makes sense. I don't want to get caught where I have the sun rising over the wrong coast, for instance.¹

I suspect that I would have withdrawn my very first published story if I had known a few more things about Mercury. I had quite a few things wrong in that one.

With the big structures in my novels, whether they are big dumb objects or big smart objects, I have to design them before I can write about them. The science in that is pretty tough but probably the best part.

THE TEACHING MOMENT

LN: There are times when I think of myself as teaching, particularly when it's a collaboration. Even when I'm working with Jerry Pournelle who is just as skilled as I am, we teach each other things as we go.

BETWEEN SCIENCE AND SOCIETY

LN: A number of scientists discover science fiction first and it leads them to be scientists. A general sense, you see that a lot.

Lui Wu first appeared in a short story and he was just sitting there when I decided I wanted to write about Ringworld and when I started writing Ringworld I thought, I need to start easy. If I hit them with the Ringworld right away readers would throw the book away. I'd scare most of them off. So I took them to a moon of Saturn, and then to the fleet of worlds, and then on to the Ringworld. So I intentionally stepped in small steps into it and taught the audience to accept the Ringworld as plausible.

I've got this imaginary reader in my head. He's a lot like me but he needs things explained to him. If I guess wrong, the book doesn't work.

WHAT SHOULD I HAVE ASKED?

LN: I think that both scientists and people in general should know that they live in a world generated by science and they should know how it works.

NOTE

1. That is an inside joke referring to an error in the first edition of *Ringworld*.

Chapter 19

Robert J. Sawyer

Star Wars is not science fiction. *Star Wars* is fantasy cosplaying as science fiction.

—Robert J. Sawyer

Prior to the interviews, Robert and I had exchanged a few brief emails in regard to the Canadian and NZ film industry, but those were purely professional exchanges and I really didn't know much about him. I did notice that he arrived at the interview with a couple of prepared thoughts about science and science fiction, and he had clearly spent plenty of time thinking about the basic issue I was trying to address with this work. Robert is known for a great variety of works, including his Neanderthal Parallax series, which includes his Hugo-winning novel *Hominids* (Sawyer 2002).

ORIGIN STORY

RJS: I was born in 1960. That decade was the space race between the United States and the Soviet Union and it captivated me. I was fascinated by the notion that people were going to go to the moon. In fact, one of my favourite popular science fiction novels was a kid's book titled *You Will Go to the Moon* (Freeman and Freeman 1959). I took as a given that a kid my age would grow up and everybody would go to the moon. You'd do it as a tourist thing and the last page of the book is a little boy who's gone to the moon with his father. He's looking up and there's Mars in the Lunar night sky and his father says that someday you will go there too. So there was this background of the science, this promissory note that we were at the dawn of the space age.

Now, the space age is over. You could argue that the space age ended in 1972, the last time that anybody went farther than 500 kilometres from this planet. I travelled farther yesterday, horizontally, than anyone has gone vertically in over forty years. But at the time, I had no idea that was the reality in front of us and I was engaged by this notion of the space age.

Secondarily, like every little boy I guess, I was fascinated by dinosaurs. My father and mother were both academics at the University of Toronto and so they started buying me non-fiction books about dinosaurs. They were both kid's books and slightly better than most kid's books and my dad would read them to me. So, I was going in these two different directions, into the future with the space race and into the ancient past with my fascination with palaeontology. One was being nurtured by the zeitgeist, everyone was talking about space, and the other was being very carefully fed and encouraged by my parents. My parents were academics, but not scientists. Sometimes I called my dad a dismal scientist because he was an economist, and that's sometimes called the dismal science.

Right up through my last year of high school I thought I was going to be a scientist. I thought I was going to be a palaeontologist. This childhood interest in dinosaurs did not abate and I had applied for and been accepted to study palaeontology at the University of Toronto. At the last minute, I decided not to do that. I had an itch to be a writer and I went and pursued a degree in radio and television arts at Ryerson University with a concentration on script writing.

COMPROMISES ON SCIENCE

RJS: It's interesting. I don't think it does create any kind of discord. I have so many beta readers who are working scientists, and I have been around an academic milieu my whole life and I don't think the scientists are any different than any of the other characters. Sometimes you exaggerate and sometimes you play down a characteristic but not any more than with other characters.

I know a lot of scientists. I wanted to be a scientist and I feel like I understand those characters. My scientist characters have to deal with things like budgets and grants and interdepartmental politics. One of my very good friends was the dinosaur specialist at the Smithsonian, which would have been my dream job. One of the best museums in the world and to be head of dinosaur research at that museum literally sounds like a dream to me. He retired a couple of years ago, happy to get out of the political viper pit that was a federal institution. It just ground him down. I hear this all the time from my friends who stayed in the academia. If anything is exaggerated in my books, it's how much fun my scientists are having.

THE TEACHING MOMENT

RJS: I do think in terms of teaching moments. I'm a hard science fiction writer, which means that the science is rigorously researched and reasonably extrapolated. To me, and to my readers, an epiphany can be a character realizing that "Oh I never should have married a jerk like that." Which is the same kind of epiphany a character might have in what's called a mimetic novel, which is a novel that's imitative of real life. Or, the epiphany can be "It never occurred to me but it must have been something—if you follow Penrose and Hammeroff—something quantum mechanical that occurred 40 or 50 thousand years ago in the human brain that gave rise to the great leap forward." That's an epiphany too, a scientific epiphany.

I like to make my reader take as much from the character epiphany as they would from the scientific epiphany. There's a school of thought that one of the things that hurt science fiction a great deal in the last twenty-five years is the notion that you should study creative writing at a university. And unlike any other subject, the people teaching creative writing tend not to be qualified in that field. A random English professor cannot teach creative writing. My father taught economics, how did he become a professor of economics? Well, by going to the top economics school in the United States and researching and there was a path. You had to be an expert, a top expert.

Creative writing professors do not have to be experts. Very rarely are they established novel writers that have been enticed into the academy. Whereas, law professors are lawyers, admitted to the bar and often have a lot of experience.

So out of that, creative writing professors who had no idea what they were talking about said "Info dump, which is where you put the science in the story, that has to go. There is no such thing as an intellectual epiphany. You have to go for the heart." They all quote Faulkner "The only thing worth writing about is human heart in conflict with itself." Stanley Schmidt, who was the editor for many years of *Analog Science Fiction and Fact* says, very wisely "That's one thing worth writing about, but an intellectual breakthrough, the joy of discovery, the seductiveness of curiosity is equally human and equally worth writing about."

That's the hard lesson that you have to bring to people that think that science fiction is escapism and fantasy and weird crazy far out stuff instead of being, quite literally, the literature of ideas.

BETWEEN SCIENCE AND SOCIETY

RJS: Six Words: *Star Wars* is not science fiction. *Star Wars* (Lucas 1977) is fantasy cosplaying as science fiction. When *2001* (Kubrick and Clarke 2001)

was the most popular science fiction film in the world, who was sitting next to Walter Cronkite to cover the Apollo landings . . . Arthur C. Clarke. There was question that science fiction writers were seen as, perhaps not prophetic, certainly as having a degree of insight and understanding, plus an ability to popularize and explain. That survived right through until the mid-70s and then in 1977 *Star Wars* turned science fiction into escapism. It was flagrantly inaccurate whenever it used a scientific term. It was quite clear to everybody who heard that line about making the run in twelve parsecs that this guy had never shown the script to a single scientifically literate person, because anyone with an ounce of scientific acumen would have seen that for what it was.

So, the indifference to science in *Star Wars* made a lot of people say no to all of it. We saw a real transition because when Neil and Buzz landed on the moon, Walter Cronkite said “Science fiction has become science fact.” As if that was the natural progression. And that was the phrase you heard in the 60s and 70s, but not in the 80s. What you hear instead is “That’s the stuff of science fiction,” which is taken as a synonym for “That’s the stuff of fantasy.” That’s just science fiction. It’s crazy. It’ll never happen. It’s not grounded in reality. That’s what *Star Wars* did to science fiction.

That turn from being the scout of the future into being the blind alley that will never be meant that a lot of scientists disengaged when they were previously quite closely connected to science fiction. Clarke worked very closely with Marvin Minsky, who founded both the Artificial Intelligence laboratory at MIT and the Media Lab at MIT, out of which so much of our advanced computing and multimedia technology have come. Clarke consulted with him enormously. Minsky when he was developing HAL and so forth. Minsky is an old-timer in this and one of the best things that happened to me in my life is when Minsky was quoted in a magazine a few years ago saying “Lately I’ve been inspired by Greg Eagan and Robert J. Sawyer.” Minsky had never given up. He was always reading the science fiction and he saw that there was cutting edge-stuff in there. But many of his colleagues gave up on us.

So, yeah, *Star Wars* was the breaking point, and if you want to bridge the gap you have to start with, *Star Wars* is not science fiction.

SCREEN AND PRINT

RJS: I was one of the writers for *Flash Forward* (Braga and Boyer 2009), the ABC adaptation of my novel and we were told by the production executive at ABC studios that every time we used a technical or scientific term, 250,000 viewers would not return from the commercial break. So, by the time we get through the commercial breaks in a TV hour, you’ve lost a million viewers by the end of the show.

Now that may have been something that was pulled out of the air, but it was an edict. We were also told that *Flash Forward*, which was a novel about the Large Hadron Collider and CERN and quantum physics, and Minkowski cubes and the nature of time, which is all science fiction territory, but we could not call the show science fiction, because that would cost us a huge part of the audience as well.

So there's this real desire to do science fiction, but in order to do so you have to say that it's not science fiction. You have to say that *Gravity* (Cuaron 2013) isn't really a science fiction film. *District 9* (Blomkamp 2009) isn't science fiction it's about apartheid. So science fiction, despite the fact that it owns the box office, is the dirtiest word in the studio.

Somewhere along the line, we have to make sure that science fiction literature doesn't allow the same thing to happen to it that happened to science fiction film. We also need to reclaim its history. Science fiction literature was created almost two centuries ago by Mary Shelly with *Frankenstein* (Shelley 1818), then developed by Jules Verne and H. G. Wells. All three of them have been plucked out of science fiction and called classics and are taught in English literature. They've been stolen. Our grandmother and our two fathers have been stolen from us, and along the way, Aldus Huxley, and George Orwell, and Margaret Atwood. So what happened because of that was that science fiction novels came to be seen as the not significant works about the future because all the best novels and writers had been stolen from us. They had the label erased.

What's happened in film is the exact same process. Since *Star Wars* tainted the term science fiction, everybody who's done an ambitious work of science fiction has taken great pains to make sure that it isn't labelled as science fiction.

So if I have a mission personally, and I think those of us who care about this do, it is to say that *Star Wars* is not science fiction. And to flip it around and say, "This is science fiction." *The Handmaid's Tale* (Atwood 1985), *2001* (Clarke 1968), those are science fiction. We have to stand up and be counted.

Lester Del Rey, who was a great American science fiction editor used to say "Science fiction is whatever I'm pointing at when I talk about science fiction." And while finger pointing is generally considered impolite in society, we stopped pointing a lot of fingers at significant things that are science fiction.

WHAT SHOULD I HAVE ASKED?

RJS: Differences in metrics maybe. Part of the reason science fiction endures like it does is because the loyalty of its fans allows it to work on a different

metric than other genres. Even though only maybe one in five people walking into a book store are going to wander over to the science fiction section, they buy the books, and you can make a living. You will never have Dan Brown numbers, but you can make it. Same with films and TV. Lower budget stuff can work and does work.

Chapter 20

Karl Schroeder

The modesty of science is to not speculate. The task of science fiction *is* to speculate. Consequently, the two are never going to, in some sense, be easy in the same room together. But this is fine because they really do different things and it's mistaking one for the other that gets people in trouble.

—Karl Schroeder

I was introduced to Karl at the convention, primarily in regard to his books for younger readers. He is more commonly known as a futurist, adding an interesting perspective on that question regarding the space between science and society. He is known for the *Virga Series* (Schroeder 2006).

ORIGIN STORY

KS: I think for me it would have probably been about 1973 or 1974 when my older brother gave me, for my birthday, a book on Skylab. I had watched the moon landings and had been interested in that and had begun reading science fiction but that was the first time I think that it became real to me that there was a connection that stories were relevant to science and the other way around. That would be the one specific moment that I could think of.

For me strangely enough I could easily have gone through my whole career without even defining myself as a science fiction writer because I just assumed that this is the way that the world works and if I'm going to write about the world then I have to include these facts. So, if we're writing mysteries, people would not consider it to be out of the ordinary that I was accepting that gravity happens in these worlds or that the sun rose or set on a regular

cycle. It's no more unusual therefore, for me to write about the future and to have spacecraft and artificial intelligence and things like that because there's strict extrapolations of where we're likely to go. You might say that I'm more of a futurist writer than a science fiction writer, but still, I just have to take the science into account because of the setting.

EDUCATIONAL BACKGROUND

KS: High school drop out because I was busy writing my first novel when I was sixteen. I had limited access to really good education opportunities in the high school system, and I knew what I wanted to do by the time I was sixteen. I wanted to be a writer. So all my attention turned to that and consequently I spent the next twenty years pretty much in poverty because I had no skills other than the one I was aiming at. I now have a master's degree in design that I picked up in 2011. It's a foresight and innovation degree and I got that because of my science fiction. Well, I got into that program essentially because of my science fiction and my previous work in foresight.

I suppose that's quite unique, but everyone that I talk to has some kind of unique route that got them where they are and within science fiction that's more true than with most places. Also in foresight, at least the older generation of foresight practitioners, everyone started from somewhere else and where they started varies wildly. From military intelligence to cybernetics and computing, to sociology and anthropology, there are essentially no rules, so I don't find myself to be out of place among those people.

TEACHING MOMENT

KS: The teaching moment as opposed to the learning moment . . . um. There is a term liminal moment that we often use in discussing writing. What you attempt to do in science fiction is break a particular barrier in the reader's mind and each story often aims to make just one scalpel cut to people's assumptions about some safe aspect of their worldview. And if you can kick their legs out from under them for a couple of minutes, they have an opportunity to look past the ordinary and see possibility. It's what Stuart Kauffman calls the adjacent possible. And in a large part science fiction is entirely about making people aware of the adjacent possibility or even that it is there. Even if you can't come up with specific ideas to leave someone with the realization that the world is not necessarily the way they think it is . . . that it does not necessarily have to continue to be the way it is . . . I think that specific social function of science fiction is critical.

To a great extent that is also the function of foresight, although in a different context and for a different audience because prediction is essentially impossible other than for strictly physical events such as, again, the sun rising. Foresight's left with studying ambiguity essentially, and what we do as consultants is often to simply try and open the eyes of the client to another kind of adjacent possible. That will allow them to break into a new category of thinking, whether it is about products, about business direction, or about strategic planning. The main thing is to get them out of the safe box. So both these, I suppose you could call them art forms, have the same aim but for different audiences and they work in slightly different ways.

The term the adjacent possible comes from Kauffman who I believe used it first in the book *Reinventing the Sacred* (Kauffman 2008), at least that's where I encountered it first. Now it is a term that sounds very vague, but there are very specific and hard-nosed definitions of it. For instance Kauffman recently wrote a paper that, I forget the exact title but it starts with "no entailing laws in biology" and his thesis in the paper is that natural selection does not select for winners, only for losers and therefore there is no such thing as an entailing law in biological development. In other words, there is not natural law that you can roll forward in time and see where biological evolution is going to go because biological organisms are not selected for, only selected against. Therefore, the creative impulse or creative force that actually generates them lies outside of natural law.

This is a very interesting argument on a number of levels, but it is a description of also what he calls the adjacent possible. It would be unnecessary to define what that is, from the scientific point of view, because we're not actually dealing with forces and laws here. Therefore I think Kauffman could be very comfortable in simply referring or pointing to it. Mystics and religious people of course will of course take this and run with it in all kinds of directions, but as far as we're concerned it simply means that again there's no entailing law influencing or defining what is possible in terms of raw possibility. That's what we talk about both in science fiction and foresight.

I often think that I should not call myself a futurist but rather an ambiguityist. The subject matter is ambiguity itself, and the adjacent possible is a good representation of that. That's the whole predictive side of futurism which, you know, is the rightly disreputable.

BETWEEN SCIENCE AND SOCIETY

KS: Well I think that science fiction needs to get over the pretension that it has a relationship with science and science needs to get over the idea that

science fiction is somehow trying to tread on its turf. Because, really, the two are entirely different disciplines united by a single word.

The modesty of science is to not speculate. The task of science fiction *is* to speculate. Consequently, the two are never going to, in some sense, be easy in the same room together. But this is fine because they really do different things and it's mistaking one for the other that gets people in trouble. Asking a science fiction writer to give an opinion of the development on a particular science for instance, that's not their job, they can't do it. What science fiction writers can do, and this sometimes annoys scientists, is read between the lines about what scientists aren't yet ready to say and sort of proclaim it as true before scientists are ready. Jumping the gun, essentially.

I've done that myself and can give you a good example. In my 2002 novel *Permanence* (Schroeder 2002) which was set around brown dwarfs, free floating brown dwarfs in between the stars. I assumed that these bodies would have aurora because Jupiter has an aurora and so does Saturn. And with massive brown dwarfs it was easy to assume they would be bright enough to read by and maybe even do photosynthesis with on a moon orbiting them, so I wrote that into the novel. I assumed all that, but about three weeks ago there was a visual observation of an aurora around a brown dwarf. Now the thing is it's not that the scientists in 2002 had not thought of this, but that it's not something that they would talk about at that point because they didn't have the observation. They might have had the theory but it's not their job to jump ahead of themselves. Part of the essential modesty of science is not to do that. I was being the immodest opposite as a science fiction writer saying "Hey! Brown dwarfs have these you know beautiful lights on them!" And I can see how that can be annoying to the people who are very, very carefully not speculating.

WHAT SHOULD I HAVE ASKED?

KS: You could've asked what I think science actually is. Which in my case is a form of extended cognition in which some of the cognitive acts are undertaken by physical devices. It's for me a definition that allows me to circumvent a lot of the ambiguities of theory that you get with Popper and other philosophers of science. However, distributed and extended cognition are both modern cognitive theories that involve the physical objects of the environment as part of the cognitive activity of either an individual or a group. If we see scientific instruments as being designed specifically to perform cognitive functions, then this is a definition that allows science its objectivity while still keeping it within the human framework. So that's the stance I move toward.

Chapter 21

Melinda Snodgrass

I try not to put myself in a situation where I have to compromise that (scientific accuracy), but I'm a novelist and screen writer and the reality is that sometimes we have to hand wave a bit and I take shortcuts because I'm telling a dramatic story, but even when I do, what I try to do is honour the research and the idea that rigorous experimentation and questioning is a good thing. The scientists are the good guys.

—Melinda Snodgrass

Even with the generosity shown by all the writers I interviewed, Melinda has to be singled out as someone who went to great lengths to help me with this project. She was one of the first authors I interviewed at the World Science Fiction Convention, and, when I mentioned that I had been having trouble securing interviews from female writers, she went straight to her phone and introduced me to Nancy Kress, Connie Willis, and Brenda Cooper, all of whom sat down for an interview before the end of the con. For that, I am deeply grateful because this study would not have been nearly as successful without those interviews.

Melinda is best known for the *Circuit* series (Snodgrass 1986), the *Edge* series (Snodgrass 2008), and the *Imperials Saga* (Snodgrass 2016).

ORIGIN STORY

MS: I think it started with my father reading aloud to me. He taught me to read before I could go to school, but he would read to me and the first book I remember was *20,000 Leagues Under the Sea* (Verne 1871). You had the fact

that there was a scientist on board the Nautilus and all of the research about the creatures. I loved that book and I think that is where I found my love for science fiction. So that was where it began, and then there was a small public library near our house and it had a section of science fiction books and it also had some books that at the time was the cutting edge of what they thought about the planets, because I always wanted to go to other worlds. I cannot remember the titles, I would have been six years old, maybe, but it was all about Venus and Mars. Venus was supposed to be a big ocean and Mars was supposed to have canals, and all of that was there. I kept reading and rereading that book and my mother would get so mad at me because I would make her check it out over and over again. Then I discovered Isaac Asimov writing as David French. It was the *Lucky Star* (Asimov 1952) books and Asimov is, of course, a pretty good amateur scientist and these kids books from the 1950s were again what everybody thought was the accepted knowledge of the worlds. It was all wrong, but it was what they thought they knew. I just consumed those books.

That was where the interest came from, and then I went to some very good private schools. There was a lot of science education in very small classes. I remember when John Glenn went up, the teacher had us track the orbits. And in other classes we did things like write plays, and I wrote one that was science fiction and they made us do research; what would a space colony look like and how would we get there and all of these things. So, it sort of permeated my world. My dad wasn't a scientist or anything like that, but I just kept reading. I enjoyed reading and I still do.

I think I always kind of knew what scientists did. I grew up in New Mexico, Los Alamos and Sandia were right there, and media gave us pictures of scientist. I think that by reading books about science and through my education science was always right there. I wanted to be a geology major in college, but I grew up in the period just before the women's movement had started to change things and I had an advisor who steered me away. I think I would have probably been very good at it because my first professor was doing research on tectonic plate movement.

So, I knew the kind of research they were doing. What always struck me as a kid, though, is I didn't understand why scientists were always presented as evil. That never made sense to me. Why would someone who is pushing the boundaries of medical research and doing all of these things always be the villain on TV or in the movies. Either they were bumbling and inefficient or they were evil and that did fit with my experience, but as I read, I kept thinking "but these are the guys who are going to get us to the stars." I wonder if some of that was a weird reaction to the bomb, you know, the 50s and the fears of nuclear devastation. People seemed to think that these are the people who unleashed hell and maybe can't be trusted.

When I was a kid, going up to Los Alamos there were still gates and there were still guards and soldiers, and we all knew that there were bombs stored under the mountain.

After I finished law school I worked briefly, for about a year and a half, for Sandia Labs. So, I spent a lot of time behind the fence with the scientists and just chatting with them and watching what they were doing. They were so cool. So, when I got too bored, I would hang out with them and just talk with them.

COMPROMISES ON SCIENCE

MS: I would like to think that I don't compromise. I would like to think that my scientists are really reasonable and realistic characters. Interestingly enough, the series that's out right now, my Edge books (Snodgrass 2008), are about the war between science and religion, and this tension between blind faith and rational pursuit of knowledge. Why I love science is that it never says it knows the answer, it always asks the next question. That to me is enormously valuable. If we stop doing that, we're in trouble as a society, as a species, and in every other possible way.

So, I started this series and by the time you get to book two I have a young physicist, and in book three I have a whole gaggle of them on the run with my hero. The hero is not a scientist so he gets to be the ears and eyes of the normal person. I have a close friend who is a physicist at Los Alamos and one scene in the book is taken from him talking about how agonizing meetings with extremely bright people can be. So I actually just lifted one of these meetings he described and gave it to the characters.

I think you can write them accurately, but you have to write the quirks as well. Some of these people have Asperger's really bad and others are just, unpleasant, but I still try to do it with love and affection.

I try not to put myself in a situation where I have to compromise that, but I'm a novelist and screen writer and the reality is that sometimes we have to hand wave a bit and I take shortcuts because I'm telling a dramatic story, but even when I do, what I try to do is honour the research and the idea that rigorous experimentation and questioning is a good thing. The scientists are the good guys.

THE TEACHING MOMENT

MS: For starters, a writer has to be pretty arrogant. So, I don't think any of us write to say that we have nothing to share, or nothing they want to say. I

think you have to have something you want to say about the human condition or the human in conflict with itself or the state of the world. There's a balance between getting that across and telling a story. You have to do it deftly because there are too many books where the writer really sticks their face in the page and screams at you about whatever it is that their hobbyhorse is.

I try not to ride my hobbyhorse too obviously, but I also think that there is something teachable in everything I want to write. I think we have an obligation because we reach so many people and we can say so much. We affect how people view things. So, I think we have a real responsibility to think about what kinds of messages we put out there.

PRINT AND SCREEN

MS: The speed of things is the big issue with the screen. Good science takes time and it is dull and you can't show that on the screen. You can refer to it in a book, but it's not something you can really do on screen. So, I think that's a different way we short cut and I don't see any way around that.

There's also the simplistic answer. George (R. R. Martin) and I have constantly laughed about *Jurassic Park* (Crichton 1990). Crichton is a fun writer but his anti-science and anti-technology themes drove me mad, because "There's some things man was not meant to know. He should not have made dinosaurs." Well no. The problem was the fact that the guy turned off the fence. It wasn't because making the dinosaurs was inherently a bad thing, it was the fat guy who turned off the fence. So that kind of message and cliché is a terrible message.

I don't think that there isn't anything that man is not meant to know, and I think in film, because we have to sell it so hard, that you get those things.

Even new shows, like the *Flash*. At least Barry is a good guy, but I found what's his name (Dr. Harry Wells) to be a very interesting character, but of course he's a bad guy. Felicity in *Arrow*. She's a great character. Not just because she's a woman and a scientist and a geek and bright and still very feminine and still very human. Sometimes I want to smack her.

BETWEEN SCIENCE AND SOCIETY

MS: For most of the scientists that I have known, science fiction was the thing that made them want to be scientists. So I actually think the disconnect is on the informed public side than it is on the scientist side. My experience has been that most scientists love science fiction and most of them grew up watching *Star Trek* or reading a Heinlein book and that made them want to

be a scientist. I feel like what I run into on the mundane and ordinary world is that people say, "Oh you're a writer, what do you write?" When you tell them science fiction they say, "Oh I don't read that kids' stuff." I think that's where we've had this problem.

My side of the conversation is always "Actually science fiction is very complex, and we've got a whole lot of interesting stuff being done." Or I say that it isn't that old Buck Rogers stuff. So I think we need to be educating the informed public to say that we may be talking to scientists and dreaming up the things that they are going to make. So you should pay attention to what we're dreaming about because if it's possible, it's going to probably happen.

I think we have the responsibility to make science more interesting and sexier. I had the good fortune to have dinner with Deke Slaton, he was the commander of the Russian-American Soyuz mission. We were talking and he said that the mistake NASA made was trying to make it seem safe and ordinary. They should have been selling how fricking dangerous it was and gotten people involved. This is dangerous stuff. This is exciting. He honestly thought that was a mistake that they made it seem so mundane. And that they should have been selling the fact that they were basically strapping people to a giant bomb. And that was part of the reason we had such a shock with the Challenger and Columbia disasters.

I think that's maybe where science fiction comes in. Sell the sizzle not the steak. And I think that scientists try to sell the steak too much. And then there's going to be the kids who do want to eat the steak. Showing a little sizzle to them doesn't hurt either. I think we also need to focus more effort on the broader public because so much of modern entertainment is also science fiction. People want those stories.

WHAT SHOULD I HAVE ASKED?

MS: I can't really think of anything.

Chapter 22

Stephen Michael (S. M.) Sterling

I decided that I would rather juggle live squid in a Laundromat for a living than be a lawyer, so I had my dorsal fin removed and did odd jobs until I could break into writing.

—S. M. Sterling

I was introduced to Stephen by an author I had been introduced to by another author at the World Science Fiction Convention. We conducted our interview over the phone a short time after the convention. Stephen is known for alternate history novels, and his series on “The Change” (Stirling 2004), which might be called alternate future history novels based upon a shift in the fundamentals of physics.

ORIGIN STORY

SMS: Dinosaurs. Seriously, I became obsessed with dinosaurs when I was about seven years old. That led to reading a great deal about dinosaurs, and that led to reading Edgar Rice Burroughs, which led to reading the rest of Edgar Rice Burroughs, and that led to the rest of science fiction. I always wanted to tell stories and I got into the rocket ship thing. I actually saw the *Flash Gordon* serials (Stephani 1936) when they were played in the summer at the school in my neighbourhood in the early 1960s, and from there I discovered the rest of the literature.

One of the things I’ve observed is that all writers have certain commonalities in their interior life. They all have long, detailed, colourful, plotted daydreams, for example. I’ve met plenty of people who do that and aren’t

writers, but I've never met a fiction writer who doesn't have that sort of interior monologue going on a lot of the time. I was telling people stories when I was five or six years old and the science fiction sort of provided the channel for which the imagination went.

Formal education included an Arts BA, a dual major in history and English. History was my great love and still is. Then for my sins, and because my parents urged me to have something to fall back on, I did a law degree. What that taught me was how to do a search. Then I decided that I would rather juggle live squid in a Laundromat for a living than be a lawyer, so I had my dorsal fin removed and did odd jobs until I could break into writing. It took quite some time. I did all the conventional starving in a garage and since 1988 I've been writing full time. I sold my first story in 1982, to a British magazine that went bankrupt before it published it. I sold my actual first story the next year to Jim Bean who was editing an anthology. He called me from New York and said he was going to buy the story, but he didn't like the end because it was too ambiguous, and he very kindly asked me if I would alter it. I would have crawled to New York over broken glass to sell the story, but after about ten minutes of talking about the end I realized that I hadn't sent him the last page and by god, without the last page the end of the story was ambiguous. So, we cleared that up.

The only education that actually gave me a direct education in writing was in high school when three others and I were in a creative writing class. The teacher gave us a paper at the beginning of class (this was, of course, long before personal computers) and told us that we were all going to write a novel over the course of the year. We were going to meet once a week to discuss it, and we could come to him if we needed help. I did write a novel. It was a terrible novel, but I learned how to do it, or at least started to learn how to do it. It's one of those things you can only learn by doing. The rest of the academic stuff was mostly useful because it sent me off reading a lot. I didn't actually do much formal academic stuff in scientific fields, just the standard things in high school and a couple of intro courses at the university.

COMPROMISES ON SCIENCE

SMS: It depends on whether you mean writing about science, the process and institution, or about a scientist as a character. When you're writing about a scientist as a character basically it's pretty much the same as writing about a farmer, except for what they do. You do have to have some idea of what scientists actually do, and I try to pick up on that. First, by becoming acquainted with actual scientists. There's been several who work in Los Alamos, the national labs here, and they're part of my writers' group here in

Santa Fe. Second, by getting acquainted with the history of science, how it developed, its methodology and that sort of thing.

And yes, I did read Karl Popper, and Kuhn.

Interactions with scientists . . . well, I talk to them a lot and I know a number of them personally. One of the things I do when I'm writing about someone with a severely different life experience from my own, I try to find somebody in that general category and run the stuff by them so that I don't make obvious mistakes. It helps you avoid the stereotype problem. It's not what you don't know that kills you, it's what you think you know but isn't so.

If you developed your idea about scientists and what scientists do from 1950s science fiction, which I was in danger of as a young person, you're going to have a severely distorted view. There's science and then there's the tropes of the scientist in science fiction. Those are two different things, but you should have some idea of how they actually function.

Reading a lot of the history also helps. Reading a lot about the early scientist you learn that the whole approach to being a scientist used to be different. It wasn't nearly as institutionalized. It wasn't associated with academic institutions the way it is today. That's partially just cultural shifts and partially the fact that low hanging fruit gets picked first. The study you can do by just going to the Galapagos and thinking hard. It's been done and you can't replicate it. You have to do other stuff and that requires a different approach.

THE TEACHING MOMENT

SMS: One of the things that's always difficult is to get across the interior experience of something that you don't do yourself. For example, you're writing a musician. I can listen to music and that's the grand sum total of my talents in that regard. But if you're writing a musician you've got to be able to get across something of the interior experience of performing or creating music. Likewise, with a scientist, you've got to be able to get across the interior experience of research and discovery. One of the things that scientists do, I've found by talking with scientists, is find patterns. They look at problems and sometimes they actually do get a eureka moment where they see the underlying pattern connecting the phenomena they're looking at. From there it's a matter of going back and determining that the pattern they sense is there and not projected by themselves.

I think that that's one of the unique things about science as a method and an institution is that it provides a way of checking what you think is true. There's been a lot of research done on things like cognitive bias and identity cognition, which humans are insanely prone to. There must be some evolutionary reason why we were so given to fooling ourselves like that, but it's been

pretty exhaustively proven that the smarter you are and the better informed you are, the more prone you are to wishful thinking and thinking up convincing reasons to believe something that you want to believe in the first place. In some respects, stupid people are actually more objective.

Science is a system of elaborate protocols and checks, which, if done rigorously, enable you to avoid those phenomena. That's why it's self-correcting and progressive (in the strict sense of the term). It actually produces more information. As opposed to metaphysics where you're basically dancing around a deep path laid down by ancient Babylonians.

With science fiction you have to also keep in mind that what most science fiction is talking about is not actually science in a strict sense, but is instead about engineering. Engineering and technology are related to science, but they aren't the same thing. If you want a vicious internal feud, turn a pure researcher on an applied scientist. One of the reasons that Nazi Germany didn't get the atomic bomb was that Heisenberg despised experimentalists.

A lot of what you run into is the myths that people have about how science proceeds. Like the "they laughed at Einstein thing." Every crank electric universe speculator and UFO-ologist says "ooh, they laughed at Einstein too." Actually, they didn't laugh at Einstein. He was taken seriously immediately and the moment there was some experimental verification of his theories they more or less leaped aboard, because it answered questions that physicists had been extremely troubled about for a generation.

One of the things you note about science and how it progresses as it goes through the centuries is how it becomes less and less frequent that a theory is disproved. It has become very rare that the biggest theories are actually shown to be incorrect, but instead are shown to be incomplete.

BETWEEN SCIENCE AND SOCIETY

SMS: That's tough. I try to depict what scientists do as honestly as I can. The eccentric genius in the basement doesn't figure all that much in my writing even though it's a venerable thing in science fiction. The other thing is that thinking about large issues requires some kind of thinking about science. You may not be able to do it because, say you're like me and you don't have the math background, but you should still familiarize yourself with science as an institution and some of its basic approaches to knowledge and learning. Otherwise you can't really understand the world we're living in.

That's also, of course, tied into the fact that you really need to know something about history to understand the present.

People tend to project themselves onto others. When that's done across cultures and across time, which is the same thing, this can lead to severe

misunderstandings. It's also part of the fact that human beings often have trouble understanding that other human beings can really, seriously disagree with them and they're not just being hypocritical or ignorant.

WHAT SHOULD I HAVE ASKED?

SMS: One of the things about writing science fiction is that you have to keep in mind that it is fiction. Science fiction is full of things that are knowingly fictional. This relates to the fact that you can't predict the future. Science fiction has grown a lot more cautious over the years. You may notice that the future history along Heinlein's lines is a lot less common than it used to be. A lot of the reason for that is because we've had more time with science fiction, and we've become conscious of the fact that we're extremely bad at predicting the future. We're even worse at predicting the future than professional futurists and that's really saying something,

For example, I don't write much near future science fiction. This is because I'm afraid of being embarrassed posthumously.

Not only are science fiction writers bad at predicting the future of scientific and technological developments, we're even worse at making cultural and political predictions. There is a characteristic error that science fiction makes when it's trying to talk about the future and that is that science fiction tends to exaggerate the social and scientific trends of the era it's in and the immediate past. If you look at science fiction from the 1950s and 1960s it's full of very fast machines. That's because that was right at the end of the S-curve of increasing speeds. Back around 1800 the fastest way you could go was to gallop on a horse, by 1900 you could go 100 miles an hour or so, by 1960, you could go well over 1,000 miles per hour. So people extrapolated that forward and they had us, by now, travelling faster than light. Actually, like almost all technological developments, the curve flattens out. Flat, flat, flat, steep increase, flat, flat flat, that's the S-curve.

I suspect that all of the things we're seeing about AI right now is exactly the same thing. We're on the steep upward trajectory part of the curve, so science fiction writers extrapolate it as a straight line that goes on forever, but there will be a plateau.

Chapter 23

Charles Stross

So . . . degrees in both Pharmacy and Computer Science means that I'm the world's only academically qualified cyberpunk writer.

—Charles Stross

Charles is another author that I had not met prior to the interviews. He is known for the Merchant Princes series (Stross 2004a) and hard science fiction novels such as *Iron Sunrise* (Stross 2004b). Lately his work has increasingly taken on more of a cyberpunk element.

ORIGIN STORY

CS: I believe it was the summer of 1969, being woken up as kid, being taken downstairs by my parents and put in front of the TV to watch a guy in a white suit climb down a ladder. I was about four or five years old at the time, and for the next six months all I wanted was to be an astronaut. Then realism set in, but it left me with an abiding interest in space science and for some reason dinosaurs, and by the time I was eight, I was trying to write stories. It was when I was about fifteen that I tried writing my first novel and I began submitting stories when I was sixteen. That was way too early, but I knew from an early age that I wanted to become a science fiction writer. This is weird and I have no explanation for it, but it goes back to childhood.

Education was the standard British grammar, single sex school. I scored very highly on English, somewhat less so on sciences, but the point where I had to make a decision on what university degree to pursue was in 1981. That was the first Thatcher Government. The economy had contracted by 10

percent the previous year, unemployment had tripled, and it was pretty much grim all around. It was fairly obvious that you couldn't just go to university get an English degree and get a job as a writer, so I was steered toward the science. Went for a career track for a professional degree that was in an area that had nearly zero unemployment, in fact had a shortage of skilled worker, namely pharmacy.

Now, training as a pharmacist is a really bad idea for someone who is a creative person and a bit prone to their mind wandering. To be a pharmacist you either have no imagination or you wonder how many people you poisoned today at work. You have to pay meticulous attention to detail and that's not really my sort of skill, and you have to focus on tasks that last an average of five to ten minutes, endlessly, rather than something that takes a year. So, I was wonderfully unsuited to it, but nevertheless persisted through a pharmacy degree, became a pharmacist, worked as a pharmacist for a few years.

I was, after the first year, looking for a way off this track and while I was at university, I got my first real computer. I was using it to support the statistical elements of the degree, but I was also using it as a word processor, and I noticed that it didn't have a word count feature. That was a huge irritant. So, I booted up the operating system and started figuring out how to write a word count program. This was a slippery slope. A year later I was enrolled in a night school computer science course, and a year after that, ditched that completely. At the time there was skill shortage of computer science people in the UK. The government was providing grants for people doing conversion master's degrees in computer science. Which was basically a bachelor's degree in one year. It was a bit brutal, sink or swim, but I enrolled in one of these degrees and graduated with a CS degree, at which point I went into the tech industry. So, degrees in both pharmacy and computer science means that I'm the world's only academically qualified cyberpunk writer.

INTERACTIONS WITH SCIENTISTS

CS: No so much. The degrees I did were primarily vocational. I didn't have the hard mathematics background to pursue computer science at a research level, because in the UK computer science is heavily balanced toward formal methods and also mathematics, much more so than in the United States, which is more of a practical applications direction. In fact, arguably, three out of four years of a computer science degree in the UK is pure mathematics.

Pharmacy is largely vocational, so while I spent some time working in pharmaceutical research companies, internships and vacation jobs back in the 80s, I've never really interacted with scientists in a meaningful way.

I do however, hang out with quite a few of them.

COMPROMISES ON SCIENCE

CS: I don't use scientists as a character very often. *Rule 34* (Stross 2011) has a computer scientist, who is loosely based upon somebody I know, who isn't a computer scientist, as a character background, with the computer science academia bolted on top. But he's largely there as a plot McGuffin and as a talking head. He's there to blow a hole in the reader's expectations of artificial intelligence as a field, by trying to get a reality check on it.

THE TEACHING MOMENT

CS: I've been characterized as a writer who focuses on ideas. Sometimes an idea or two will bite me and I start trying weave them together and see where they're going to go. One example is *Rule 34*, where a cluster of ideas occurred to me. I had been looking into where we could expect personal computer technology to take us by about the year 2022. This was written around 2008. Some stuff that was cropping up on my radar at that time was 3D printing, which was visibly becoming a thing. Artificial intelligence research and client services. I was also talking to Karl Schroeder, who is also here, who is a professional futurist about how AI would find practical applications.

Artificial intelligence is very much a grab bag term for anything we don't understand that has to do with a computer. Once we know how to do it, it's no longer AI. Arguably, this pointed toward the idea that what we think of as intelligence, isn't really. It's a cluster of behaviours that we recognize but are too complex to easily model in our own heads.

So, I decided to write a book where I focused on future computer crime, notably 3D printing crime where you used a printer to print an illegal object, from working guns all the way up to paedophile sex dolls. And also, the use of libertarian paternalism and nudge economics to nudge people to do things, and distributed computing as a platform for doing this. I sort of followed this by finding a coherent picture of how this would be structured using a couple hapless moobs who get sucked into this and a police detective as the cursor for the reader, to move their awareness around through what's going on in front of them.

I tend to write puzzle book novels, where the reader has to figure out what's going on in front of them. My joke these days is that I'm currently spending a decade writing urban fantasy because that is a much better way of understanding how we relate to technology.

BETWEEN SCIENCE AND SOCIETY

CS: The key thing I want to communicate to both scientists and the scientifically informed public that reads science fiction is “Beware of science fiction as a guideline to what’s out there because it’s an inherently ideologically fraught activity.” Karl Schroeder has this rap about no technology is value neutral. They all come with political agendas attached. If you want the internal combustion engine to power your horseless carriage, then you will end up with highways and you will end up with jaywalking laws. You’ll end up with drunk driving laws. These are political consequences of the adoption of technology.

Now, science fiction itself, certainly in the modern twentieth century mold, post Hugo Gurnsback, was itself partly intended to illustrate an ideological view of the way the world was going. It was a modernist project. There were other modernist projects out there. There was Marinetti’s Futurist Manifesto. There was the Fascist Manifesto of Mussolini. There was a certain Mr. Lenin and a certain Mr. Hitler. The technocrat movement that Gurnsback was into, as was John W. Campbell, was an avowedly ideological movement saying that engineers should run society on rational and efficient grounds (whatever they were). Luckily they didn’t get taken seriously enough by enough people to become a true mass movement and build their own pyramid of skulls, but I’m pretty sure they would have if they could have, because the same failure mode was built into them that was built into fascism and communism and all the other totalitarian ideologies.

Science fiction, however, has sort of transcended that particular political program. We would think of technocratic fiction these days, as hopelessly dated and quaint, and very naïve about the way the world works, but a lot of its assumptions are still there. There’s a certain strain of hard science fiction writer that is still boosting the idea of we’ve got to colonize space because the Earth is too small to keep our eggs in one basket, or whatever. The whole space cadet thing begs the true question of why. Arguably that’s harking back to the closing of the American frontier and the idea that if you are an expansionist power you have to have somewhere to expand into.

I find this attitude very, very suspect. The more recent one that I’ve become suspicious of is the singularitarian movement or the transhumanists, because when you deconstruct transhumanism you discover that it relies on a lot of the same design patterns as millennial dispensationalist Christian apocalyptic fervour. The singularity is the second coming. Machine Jesus. We’re all going to be uploaded into AI heaven. Kevin McCloud came up with “the rapture of the nerds.”

So, it’s very important to try to look for the ideological underpinnings of science fiction if you’re going to take it on board. A lot of readers read it

uncritically, as fiction that's entertaining. And yet, it is entertainment that has a political agenda implicit in it. Look at Goebbels's Ministry of Propaganda and so on.

So that's what I'd like to get across. We need critical readers.

WHAT SHOULD I HAVE ASKED?

CS: You're asking me to look into my own blind spot, because the questions you've asked so far have been pretty good and have let say hit the things I'd naturally want to say.

A lot of science fiction isn't actually about science. It's about two-fisted engineering stories. If you went with the traditional puppies¹ model of 1950s stuff, it attempts to explore the human condition under circumstances that do not apply but plausibly could apply given our understanding of the universe. This is one of the reasons that faster than light travel is a bit difficult to write these days, as is time travel. We can certainly do plausible futurist science fiction about nanotechnology, artificial intelligence, and so on. I'm beginning to relegate FTL or time travel to the realm of fantasy which is fiction about the human condition under circumstances that could never exist in reality. But it is still useful for illuminating emotional corners of the human psyche

Science doesn't necessarily get a look in here and we're in great danger of confusing a boundary condition between the plausible and the impossible. Consider *Star Wars*, fantasy or science fiction? Fantasy. And a lot of the stuff that is sold as science fiction really fits in the same ballpark as *Star Wars*. It's not plausible. Actually, the plausible stuff is pretty thin on the ground these days. It always has been.

So, circling back around: by having identified that definitional boundary between fantasy and science fiction can it tell us anything useful about science in a cultural context?

NOTE

1. "Puppies" refers to a series of conservative groups that, from roughly 2014 to 2018, manipulated the nomination process for the Hugo Awards in an attempt to shut out nominations that did not represent what they considered to be the appropriate, technological, and space exploration focus of science fiction.

Chapter 24

Vernor Vinge

In very high-flown terms I would say that science fiction is to the body of society what dreaming is to an individual human.

—Vernor Vinge

Prior to our interview, I had never had the opportunity to speak with Vernor. In fact, the only thing I knew about him was a comment from the writer that helped me contact him, and that was that his last name is pronounced Vin-gee. Vernor is known for his hard science fiction, and multiple Hugo Awards, including best novel for *A Fire upon the Deep* (Vinge 1992), *A Deepness in the Sky* (Vinge 1999), and *Rainbows End* (Vinge 2006).

ORIGIN STORY

VV: I was slow to learn to read. My parents told me that they were beginning to get worried. The first book that I ever read all the way through was Heinlein's *Between Planets* (Heinlein 1951) and one thing I recall from that time, not from *Between Planets* but in general, was that in stories the world was always the same at the end of the story as it was at the beginning. Still as a pretty young child, I realized that there was only one form of fiction that appeared to violate that rule, and that was science fiction. For me, that was a major thing as far as stuff I like to read.

The other thing, which I can't really explain except as a personality quirk, was an intense desire to be very smart. I used to remember hounding my parents to teach me some algebra at age five or six, so eventually my father started going through a few things, like formulas for the circumference of a

circle, and that kept me quiet for a while. Basically, I always had this great hope of being some sort of prodigy, so on my own I would look at books and try to figure things out. Later on, I had a relative who gave me a book called *calculus made simple*, or something like that. It's a rather famous book from the early twentieth century, and it would pass muster as a textbook these days, but it included a lot of things about differential calculus that you can explain conceptually and that meant a lot to me.

For me the science was just there, and a big factor in that was that as soon as I started reading science fiction where science was glorified, that was a boost as it generally is for young people who read science fiction, and that made me more interested. I stayed focused on math pretty much from the beginning, because math was kind of the high point of intellectual performance, but also, my father made a point which I think has an awful lot of truth to it and that was, If you can't decide what you want to do in the sciences, math is a good jumping off point. You can postpone the decision about specialization for a long time if you have your main focus in mathematics. I still think that's true. Although, after you have a master's degree in math, you'd better start specializing in something.

Formal education was high-school, undergraduate math major, masters and PhD in math. When I went on to teach, this was at a time when no one really knew what to do with computers. I had never taken a computer course, but that was a time when it was pretty easy for someone with a math background to just study up and learn it and so I ended up taking my math PhD into computers and teaching and researching there.

COMPROMISES ON SCIENCE

VV: I'm sure that I'm not ideologically pure in that regard. However, examples of compromises don't pop to mind. What does pop to mind is being confronted with the problem, over and over again. A couple of things I've found about that is that often times, trying to work your way around that problem . . . trying to not violate your sense of what would be plausible, leads a person to consider explanations that you wouldn't have thought of otherwise. That often is a great plus, although it means you have to stop and really think about it. As one of my alpha readers commonly puts it, "This works so well, it's so great, but it's bullshit. What could we do to make this plausible?"

Sometimes these are just character related things, but in other cases they are technical things about things that people just wouldn't do, or ways that things just wouldn't happen. In fact, I think that I really value that in my

writing. I think it's something that in general is an important reasoning skill because some of the most important things about future developments in the real world is that they will be counterintuitive either because the domain of possibilities is larger than people currently believe, or the contrary is true. As knowledge progresses there becomes some limited way that the problem can be conceived such that when you shift to the constrained context, all the stuff that makes it seem wrong is found to be irrelevant.

So, this process of thinking, "That would be neat but it's bullshit" I think that for more than just writers that should be a point where people should step back and ask, "What could make it valid?" Inside the box and outside the box rethinking of things.

INTERACTIONS WITH SCIENTISTS

VV: Fairly frequent, you know, a lot of my friends and colleagues are people from various universities and one of the really nice things about writing hard science fiction is that there are career scientists who actually read that stuff and enjoy it. If they've bought into the characters and the action—I don't think all humans are like this—it makes the work on their own to look for that explanation of the non-intuitive or the possible. That means that if you can ever snag a first-rate scientist with what's in your story you have somebody who's willing to talk to you and explain things including plausibilities and what could be hiding behind those plausibilities.

Overall my interactions with scientists has been flattering, entertaining, and informative, but it also has a positive effect on the writing.

THE TEACHING MOMENT

VV: Actually, having been a teacher for about twenty-five years, you'd think I have some reaction to that, but that's a term, or maybe an idea, that I really have not run into that much. Certainly, it's a big thrill when you say something and people get it, and they realize that they've gotten it. I've spent some time sort of thinking and speculating what it takes for a teacher to be able to do that and finally came to the conclusion that there are plenty of teachers who are trying too hard to teach, but what works actually depends on the nature of the particular student. There are grand things that will help you get through to the student and make them understand things, but there are a lot of situations where there is one type of student that just is not a match for a certain approach, whereas it works fine for another.

BETWEEN SCIENCE AND SOCIETY

VV: In very high-flown terms I would say that science fiction is to the body of society what dreaming is to an individual human. So, dreams are mostly nonsense but sometimes they actually give you an idea. I've had at least two stories where ideas in the story came from a dream. At the same time, dreams alert people to things they've been ignoring but they could be really, really serious issues. You've probably heard Ray Bradbury's comment about whether science fiction predicts the future. Paraphrasing, he said that science fiction is really not about predicting the future. Often, it's written to prevent it.

There's something in the real world that is mainly a trend that has developed in the late 80s and onward and that is scenario-based planning. A big chunk of that is what science fiction writers do. The added thing that science fiction writers do is to try to engage the emotions of the reader, which, in some ways, is a very powerful thing. It causes smart people to be willing to consider things that if they were presented in other ways they would dismiss.

WHAT SHOULD I HAVE ASKED?

VV: Ah, I should have thought of that ahead of time. That's a very important sort of question.

I think that the things we've been talking about over the last few minutes, about relevance to thinking about the future, that's where I would go. We really are in a situation where, unlike when I was a young child where the idea of a story where the world was different at the end than it was at the beginning was very rare, nowadays the science fiction ghetto has grown up and swallowed the universe.

That doesn't mean it's respected, necessarily, but the prominent thing is that stories where the world is different at the end are now common. I think that's a reflection of what we've done over the last fifty years.

Chapter 25

Connie Willis

The science and the human, it informs each other in science fiction.

—Connie Willis

I was introduced to Connie Willis by another writer I was interviewing, and, like many of the other authors, the first thing she did was go well out of her way to arrange a time when we could sit down for the interview. In the interview, Connie was quick to focus on the genre and the nature of the genre and couched all of her comments about herself in terms of what the genre allowed her to do as a writer. Connie has won a plethora of awards, including several Hugos, including best novel for *Doomsday Book* (Willis 1992a) and *To Say Nothing of the Dog* (Willis 1997)

ORIGIN STORY

CW: Unfortunately, the stories of writers are almost always the same. I started out being an avid reader, swallowing whole everything that I came in contact with, including the copy on cereal boxes. I read widely and constantly as a child. In sixth grade I read *Little Women* (Alcott 1868) and I decided I wanted to be Jo the writer, Jo March. I still want to be Jo March the writer. At age thirteen I stumbled across a book called *Have Spacesuit Will Travel* (Heinlein 1958), by Robert Heinlein. I fell in love with science and began scouring the library, which was my only source of books, and began reading anything and everything that had anything to do with science fiction. I almost immediately stumbled upon the years' best collections of short stories, which gave me a better idea of the scope and range of science fiction and how you could do almost anything, a whole wide variety of kinds of writing.

I did not think of myself as a science fiction writer for a few years after that because I was thinking that I like science fiction but I may find something I like that won't work as science fiction and I'll write that, The thing was, however, I've never found any story I wanted to tell that didn't work beautifully in science fiction.

It's such an amazingly diverse and interesting field. Many of the aspects of science fiction give me a leeway that you don't have in other forms of fiction. Most particularly, that you can take an idea or a concept and sort of devise a thought experiment where you set up a world where this situation is true and explore what the consequences are rather than simply talking about them. You can act it out on these little homemade stages. That to me is a tremendous advantage of science fiction.

It is also a tremendous advantage that in science fiction you can talk about issues indirectly. They're masked. You're apparently writing a story about aliens set on another planet, but you're actually examining the political situation here. You're talking about free will so you devise an alien that doesn't have free will. I find that that makes it possible to not only explore what you think and what you think you think, but what you really think. You can kind of fool yourself that you're not examining that topic and then your real feelings and the real complexities of the issues come out. I'm more in love with science fiction than when I started.

I was an English major. Having looked at or read lots of things about science fiction writers I knew that a vast majority of them were not able to make this a full time you know, a day job, so I never really intended to become a full-time writer.

My hero was Zenna Henderson who was a teacher and she produced a small but wonderful body of work, *The People Stories* (Henderson 1995) and she wrote during her summer vacation and her Christmas vacation, spring break and that was kinda how I saw my life progressing so I trained as a teacher, I had an elementary education major and then basically picked up an English major because I wanted the excuse to be able to read books while I was in college. That's the only way you can read books while in college.

So, I don't have any scientific training at all and in fact everyone always says "so your husband does your research for you?" The answer to that is "No, I'm perfectly capable of doing my research on my own" but I have always been very interested, obviously because I was writing science fiction, in science and how to make science accessible to people.

One of the gifts that Robert Heinlein had was that he knew how to explain anything in terms that made it sound like a seventeen-year-old boy was just talking even though they were quite complicated concepts. He also knew how to split up his explanations and his exploration of science in a way that made it sound interesting and not difficult.

That is something that I think echoes into my work. There are lots of scientists writing science fiction but, I'm not. I do try to do all of my research on the science so that it's accurate and my position is always on stories so that if I'm making up a science it needs to be extrapolated from what we now know. There are exceptions with things like faster than light travel or time travel that I'm just making up, but that also I'm trying to stay true to the whole scientific method as a bellwether. This is especially true when the characters come to an epiphany about chaos theory and how the world actually works. There's a series of seemingly unrelated events which they observe and then make that critical new connection because they think in terms of scientific discovery.

Scientific discovery, I always think that's the wrong word because they don't, unless you're finding a new element, a new kind of ore, a new animal, they're not really discoveries. What's happening is more that they have seen a connection between these two things that no one else has seen before and that in turn makes it possible to understand the world better.

COMPROMISES ON SCIENCE

CW: Well I don't have a lot of scientists, per se, in my stories. I much more opt to have ordinary people dealing with the consequences of science rather than them have a scientist as a key character. The viewpoint that I come toward science from is that I've lived with a physics professor my whole life and even though I've seen scientists in action, and I've seen the kinds of people they are, I'm always struck by the supposed (from C. P. Snow onwards) dichotomy between science and creative thinking. I don't see it. My husband and I have had conversations about how similar the creative processes that I employ in taking an idea and putting it into a story and the creative processes that scientists have explored in coming up with scientific discovery. The whole idea of examining all the possibilities of something, trying to see the world from all possible angles is almost the same.

I find that having all this stuff rolling around in your head makes it tough to make sense of it, but then, just like with scientists, there is the epiphany. You're going to sleep or getting on a bus and suddenly everything coalesces into one, into an idea, a new idea. When I read books about scientists who have made stunning discoveries, I see the same thing. I see no dichotomy between science and the arts, so when I write, that's kind of the attitude I have toward science when I do have scientists as characters. Also, when I have directly employed people who are involved in coming up with an epiphany about how the world works, they go through exactly the same process as a scientist as I do as a writer. It is the scientific method but not necessarily the

several step scientific method that you'll read in textbooks. It's that certainty but it's also this bringing together of connections that nobody else saw.

TEACHING MOMENT

CW: The teaching moment, okay, that's a tricky one because I have very mixed feelings about that. On the one hand there is no denying that I have learned all kinds of stuff through my reading of fiction. Heinlein taught me the mnemonic for the planets, and taught me all about the various constellations, and the names of the stars, and how space travel would work, and how orbits work, and all those things. I absorbed all those things from what I was reading, and every story has all kinds of information in it.

On the other hand, I am very firmly against the very Victorian approach to writing which is that everything is to teach, and you need a moral to your stories and you are writing for the good of the person who is reading it. I'm writing to tell them a story. If I'm telling them, speaking with authority on anything, it's about how the human heart works. Not because I would never write a book because I think kids need to know more about space. If that's the case, I would write a nonfiction book about space and try to make it as interesting as I could. But I would not ever write that as a story. When I'm writing a story, I'm not thinking that I'm going to teach you now about black holes. I wrote a story about black holes, but it was actually about Schwarzschild. I had read that he had this horrible disease it's a disease where the skin basically reacts against itself and peels off in huge pieces. The body's sort of eating itself and this was happening to him when he was on the Russian front in WW1—a black hole if there ever was one—and yet in spite of all these horrible things that he was undergoing he came up with the concept of a black hole and a Schwarzschild radius. So, then I'm like okay did he come up with it in spite of these awful conditions or because of these awful conditions. Because he was in fact experiencing black holes himself. He had been sucked in and he could not get out, so the concept of the short story is that that radius suddenly became real to him. That was how he was able to make that scientific discovery.

So, if you read that story you'll learn a lot about Schwarzschild's life, you'll learn a lot about how black holes work, you'll learn a lot about what a Schwarzschild's radius is and all those things, but that isn't what the story is about. The story is about how the things that happened to us, in this case how we ourselves can be sucked into emotional black holes that we can't get out of and how we can make something good out of something horrible in our lives.

That's what I really care about in the story the rest of it is just peripheral. Well, that's not quite right. It's related. It's all of a piece but without the

human heart of it I would've never have written the story. I would have never written a story saying I want the reader to understand the black hole. I do want people to understand them, but I want them to understand the idea on an emotional and visceral level too. I want them to know what a black hole is like if it happens to you.

I think a lot of times there's a whole subgenre of science fiction where they use the science as a metaphor for the emotional. Like Ed Bryant's *Particle Theory* (Bryant 1981), in which a scientist has a metastasizing cancer which is eating wildly, growing through his body and at the same time he's an astronomer who's watching a metastasizing event in the universe that is happening, and threatening to eat the planet and the two inform each other. The science stands for the emotional, the emotional stands for the science and you get a deeper understanding of both of them.

There's another story by Pamela Zoline called *Heat Death of the Universe* (Zoline 1988), in which on the surface level it's a story about a housewife who's becoming progressively more overwhelmed, and her life is descending into chaos and despair, that's all on the surface of the story. Underneath it's about entropy. It's an exercise in entropy and she has basically shown you what entropy looks like in terms other than the mathematical and scientific. So, which is more important? You come away from that story knowing a lot about how entropy works but that wasn't the main intention. The science and the human, it informs each other in science fiction a great deal and so the one thing I am firmly against is that periodically somebody in science fiction will say "well kids need to know more about a, b, or c and so I'm going to write a series of books the purpose of which will be to educate them, to teach them that science is good or make them want to be scientists." I'm sorry, no, those aren't worthy goals for fiction. Fiction is more important than that. It has a bigger vision. So, if you want to do that write an essay, write a letter to the editor or something, but don't waste literature on such small goals because literature is capable of doing that plus a whole bunch more and it should be doing a whole bunch more.

BETWEEN SCIENCE AND SOCIETY

CW: Well I don't think I'm in authority to speak to that.

I think this is sometimes a misunderstanding of how important passion is to the situation. So, for example, right now I see in education that they've been obsessed with how do we help kids read better, have better math skills, and all these things. They seem to have adopted the answer of ignore everything else focus totally on reading and writing, reading and math, give endless tests and do just lots of forced memorization. Just force it in. It's just a force-feeding

approach and you're like "that's not going to work." What you need to do is get the band back, because in the band there will be a kid who just becomes passionate about being in the band. When they are passionate about being in the band, then the rest of school and all the things they need to learn will suddenly make sense. They'll be interested enough in the band that they want to read the article about it, or be interested enough that they want to learn the math about it, or become interested enough that they really love the music and from that learn how to love everything else.

I know my daughter is a criminalist and she cites two major influences in her life like how I cite Heinlein. Her major influences were *Charlie's Angels* (Goff and Roberts 1976) which has no social redeeming qualities. When I watched it, I thought, oh how exploitive and you know how dumb because you know its relation to reality was almost nil. But when my daughter saw it as an eight-year-old girl, she saw girls doing interesting jobs that up until that point they hadn't been able to do. And she saw them being extremely competent in those jobs and spending their lives not looking for husbands but working in a great job and getting a tremendous amount of satisfaction from that job.

Her second big influence was *X Files* (Carter 1993), which of course we all know how scientifically solid *X Files* is, but it's very fun and she wanted to be Scully. When she did a speech not too long ago at a college where mostly young women studied forensics and many of them cited *X Files* as a major influence. It made them fall in love with the idea that Scully is the scientific one as opposed to crazy Mulder and his conspiracy theories. They fell in love with the idea of women as these competent women who could do the science, could look at the evidence and draw conclusions. Women could be the voice of reason and the voice of sense.

Scully is a direct descendant of *Alice in Wonderland* (Carroll 1865) who is also a voice of reason among madness. They totally related to that and from that wanted to be like Scully and wanting to be like Scully would be far more likely to produce good scientists who had all the qualities you would want in a scientist. You know the logic, the absolute integrity, the following the evidence wherever it leads—all the things we admire in scientists.

It's the passion that I think is so important and I feel that when I just adore Neil Degrasse Tyson even though he committed a horrible crime against Pluto, my favourite planet. I blame him, I blame him partly because he's so articulate and fun, but he makes science look fun. He makes it look interesting, he makes it look accessible, Asimov used to do that. Sagan used to do that.

I'm not saying that scientists have to be a scientific popularizer. That's not what a scientist does. You shouldn't waste your time being a popularizer, you should be doing real science. But science also needs these popularizers and what they bring is not so much as information as it is passion.

Neil Degrasse Tyson, you think is going to jump right out of the screen at you, he's so enthusiastic, he loves science, you can tell he loves science, when he's talking about black holes or Pluto or whatever. He's getting all worked up and the message that's coming across is that science is something really exciting. That makes you enthusiastic and it's not dry facts. And the same with Asimov. He was wonderful at it, and Sagan also was very good. Sagan wasn't enthusiastic in the same way, but he was fascinating. He made it fascinating.

I think that you'll see if you go round to science fiction writers ask them about any given scientific topic they'll almost always say "okay so I heard the coolest thing the other day and it's so cool" and it's the excitement that matters. They genuinely are excited about and with that excitement and enthusiasm you can sell anything that way.

I think that that's the secret you know, when C. P. Snow talks about the dichotomy. I don't think he was wrong about that, but I think the answer is not that science needs to push its agenda. It doesn't need to push a "we need to educate the public" kind of thing. No. It needs to convince the public that scientists are doing something so interesting and exciting that they can't wait to find out about it.

My daughter's forensics panel at this convention, people kept coming up to me and saying, "we wanted her to go on forever, she knows so much and she knows such cool stuff." Because these are people who really you know they can wax poetic over just about anything involving science and I think that enthusiasm is really important.

Also, I think showing that the creative process in the arts and the creative process in science are just the same matters. Everybody thinks "oh the creative person comes up with these ideas their minds are so fruitful. They have these wonderful connections that makes it all kind of la la la, there's no work." Whereas they think that for the scientist, "It's all work and no la la la." The truth is they both have tons of work.

Robert Silverberg, who is charming, is a master at the type of speech he gave last night. He makes it look effortless, but it takes enormous amounts of work. It's a Fred Astaire moment. Fred Astaire used to wear out six pairs of rehearsal shoes for one single dance number. And he did that so that when you watched it, it looked effortless. It looked like he was just making it up, like he had just thought of it this minute. Silverberg is the same way. It looks totally spontaneous and yet it is carefully worked, every pause, every word, everything. Writing is like that too. It's tons of work. It's lots of tedium. It's the same exact tedium as graphing results and doing lab test, and checking your data and all of those things both are full of careful tedious meticulous work and yet they are both full of this exciting, creating this "oh my god I never saw that connection before" kind of work.

So, I think if that reality could be communicated better. Forget about saying “people need to know more about dinosaurs.” The reality is that the passion and the purpose are actually very similar, and it is just as easy to get excited about science as it is to get excited about anything else. And with the passion, a lot of the problem in learning would be solved.

If you look at little kids, they know that science is exciting, they love dinosaurs, they love space, they love volcanos, oh my god volcanos! And yet by the time they are adults they’ve convinced themselves that science is over here and pretty boring. I think from a political point of view the whole know-nothing movement has exacerbated the problem because scientists are so worried—and rightly so—about pseudoscience and about idiotic theories with no scientific justification. The anti-vaxers, there is not global warming, etc. Scientists are so determined to avoid being associated in anyway with the kind of dumb thought processes that go on in concocting those theories that they kind of present themselves as even more professional. That leads to emphasis on tedium hard work, careful results, accuracy. That increases the problem. That increases the separation.

With global warming, I have felt all along that Al Gore is the wrong spokesman. I think we need a Neil Degrasse Tyson of global warming, and I think if we had that, within months we could turn a lot people around. You get the right spokesman to explain things in ways that raises the enthusiasm and you could just work wonders.

WHAT QUESTION DIDN'T I ASK?

CW: I don't think it's a missing question necessarily, but I do think that you can't discuss this whole issue without the human element in science fiction. People have the mistaken idea that science fiction is stories about science. It's not. Its stories about the interface between science and the human beings, or technology and human beings.

All of my stories are about the impact of whatever, science or technology, on people at a grass roots level, so I wrote a story called *Even The Queen* (Willis 1992b). It was about a scientific breakthrough which made it possible for women to no longer have to menstruate unless they wanted to get pregnant. I could've told the story from the point of view of the sort of standard 1950s approach, where I had a scientist come up with this breakthrough. I could've told it from a political point of view where the scientist came up with the breakthrough and everyone had to try and convince various factions that this was a good idea as opposed to you know fighting against the religious people and fighting against various people who didn't think this was right. Instead, what I did was I went twenty years in the future after

this technology had been in existence and I tried to show through its impact through different generations of women.

So, you have the grandmother's generation who had their lives absolutely transformed by this. It offered them freedom in so many ways that they're eternally grateful and they can't see any negative side to it. Then you have the next generation, which is comparatively clueless about what it was like without this technological breakthrough. They don't really appreciate it or understand it and they either kind of accept it or they can't imagine not having it. Or, in the case of the one daughter, she has decided that women have been deprived of this wonderful thing. She has joined the group where women voluntarily menstruate. And then I have the new generation who brings the common sense of youth and the distance from the past.

I could've used any technology. You could write this story a thousand ways, with those three generations. It's always the same situation. You get the breakthrough, you get the backlash and the kind of clueless acceptance and then you get the third generation that incorporates everything. It can be handled as a tragedy, or it can be handled as I did, as a comedy, but the way that technology has sifted down into technology in all these different ways is what I was really interested in.

Not all science fiction writers do that. A lot of them directly deal with science. When they do that, we call them hard science fiction writers, and in their stories the science is upfront, and you can't ignore the science it's right there. In mine people are frequently saying "where's the science" and I'm like "It's back here. It's behind. It's running the show. It's in there. This is how it comes down and finally reaches the grassroots level. This is what the impact looks like." I write about the human interface. I think that that's a really important part of the equations because I think if we're more aware of that we learn and know more.

If I were doing an education program that is how I would be trying to educate them. Our life is impacted all day, every day, every moment by technologies. It's impacted in ways that you have not even considered and if you realize that human interface you would be a lot more interested in science because you would realize that it's a part of your life. It's like those people that say "Oh I don't do politics" yes they do! You do politics! If you don't vote you are *really* doing politics through that action. You can't avoid it. It's like the air you breathe.

So, with science, I do think if people were more aware of that immersion and people kept pointing out how science is affecting life on a daily basis, then I think they would see the science as more integrated in their life. It is integrated. They just aren't aware of it.

Chapter 26

Charting the Space of Science Fiction

There are countless temptations when it comes to discussing and analyzing the content of these interviews. For example, someone familiar with the educational and psychological research on gifted children will note that in the origin stories of almost all of these writers there are multiple indicators of growing up as an unrecognized gifted child. Further, many of these authors discuss struggles and challenges that are now known to be common for children with a precocious engagement with sophisticated intellectual reasoning (Alvarado 1989; Lovecky 1993; Rinn and Bishop 2015). Research has shown that such an experience has lifelong psychological impacts and it is easy to surmise that it probably has some bearing on how they conceptualize and internalize their role in the space between science and society, particularly in terms of the common mention of a drive to effect positive social change through their writing.

As fascinating as that possibility might be, it is only tangentially related to how these authors conceptualize the space between science and society and how it shapes the roles they believe they play in that space. Perhaps more importantly, however, questions related to growing up as a gifted child are not something that they are explicitly discussing in these interviews. It is not a reflection of things that they consciously engage as part of their intent or understanding, and it is questionable if it has any bearing on what their comments tell us about how mediated space of science fiction might be charted or described. It is also important to keep the broader goal of such an effort in mind, and that is to provide a description of this space that enables scholars to easily integrate some of the basics of the authors' professional perspectives into their study of genre.

The primary focus of what follows is simply an exercise in identifying patterns or commonalities in the interviews that indicate how these authors

understand the space in-which, and from-which they work. However, as is the case with any mapping exercise, what is represented and how it is represented will reflect an underlying conceptualization of the structure of the space. In this case, since there is no physical geography inherent in the space being charted, the map itself will be entirely conceptual and it is critical to approach what follows in terms of the cognitive framework being used to depict the content of these interviews.

THE SCIENCE FICTION ECOSYSTEM

When multiple independent actors collectively form a self-identified but unstructured community with a business or economic imperative as a critical element, the concept of an ecology or an ecosystem can be an effective framework for discussion and analysis. This is particularly true if that community exists within a larger social, political, or economic context that can stand in as a proxy for the environment in a biological setting. As an example, the concept of an ecosystem is such a common way to conceptualize the news media as a social, professional, and economic institution that it is a central element in undergraduate textbooks on the topic.

The word “ecology” refers to the relationship of things as they interact with one another and their environment. In short, it shows the interdependence of forces at work that interact with one another to create today’s news environment. Attempts to explain this environment which ignore the ecological relationship of technology, regulation, the concentration of ownership and the competition between news providers will not provide a proper understanding of the news. (Harrison 2006, 69)

While many, if not most, of the specifics of the news ecology, such as government regulation, are not directly applicable to a discussion of science fiction as a social institution and profession, there are some indications in these interviews that the general idea of an ecosystem might offer significant value for understanding the space of science fiction. At the very least, as it does with the news media, a better understanding of the dynamic environment in which these and other authors are creating these texts, and the imperatives, ideals, and professional demands that influence what and how they write, will add depth to analyses of everything from the image of the scientist to their engagement with social phenomena through their craft.

This is not a simple task, nor is it something that can be fully accomplished here. Unlike a subject such as the news media, where there is ample research into the business and professional aspects of the industry, as well as how the

industry, organizations, and individuals surviving within it interact with other social institutions such as governments, there is not a great deal of material to work from when it comes to the political economy and pragmatic business aspects of science fiction as a profession. There is an interesting series of essays on the profession of science fiction, many of which have been written by prominent writers (Jakubowski and James 1992), but they offer only limited insights into what it takes to survive as a professional, and there is nothing comparable to the systematic and extensive literature on journalism as a profession and the news media as an industry.

The dearth of work on science fiction as a profession might also have a bearing on the overwhelming sense among these writers that they have been ignored by academics, that academics do not appreciate their artistry or profession, and that they need to interject their voices into the academic discussion. In the comments made regarding the reluctance to participate in a project like this, it was common to hear some variation of the idea that academics just did not seem to understand, or care enough to try to understand either the genre or the profession. These interviews offer a few insights, but there are likely to be some things that need a great deal more study and analysis before a detailed and dynamic image of the science fiction ecosystem can be developed. Still, charting the social and political space of science fiction with the conceptual framework of an ecosystem in mind might offer a sketch that can serve as a starting place for that effort.

At the very least, the concept of an ecosystem provides a simple way to organize the exploration of similarities and differences in the way these authors describe themselves, the genre, the profession, and the conceptual social space they occupy. As with journalists, these writers share an understanding of who they believe they are, what they can and should do as professionals, the nature of their profession, as well as the ideals and issues that are inherent to that profession. Just as with species in a biological ecosystem, while sharing those commonalities, these writers must also find a niche that represents unique qualities that enable their survival as professionals in a competitive environment. They must have different and sometimes unique characteristics that are associated with their value to those who provide the economic support needed to survive in the industry. The emphasis here is on the commonalities, but just like news outlets or journalists, science fiction authors have to find ways to do the same thing in different ways in order to secure an audience that will pay for their work.

Chapter 27

Storytelling as the Essential, Defining Element of Science Fiction

I'm writing to tell them a story.

—Connie Willis

One of the things that is easy to miss but becomes obvious to the point of overwhelming as soon as you think to look for it in these interviews is that for the authors, it's all about the story. This goes beyond the fact that they view or discuss just about everything about the genre through the lens of storytelling. For these writers, storytelling is quite literally part of who they are. They explain most things in terms of storytelling or elements of storytelling and for them, it defines the bounds of science fiction in the mediated space between science and society. While they might offer different ideas on what other elements are essential to science fiction, storytelling is the singular, necessary defining thing upon which they all agree. It is what distinguishes science fiction from other media products that exist in the conceptual space between science and society. If you aren't first and foremost telling a story, it might be about science, but it isn't science fiction. Connie Willis states this directly in the teaching moment part of her interview, but references to storytelling as fundamental are common to the point of universal in these interviews. To use a sport analogy, storytelling is the field upon which the game is played.

The sheer number of explicit references to storytelling in these interviews, the way in which these authors frame and conceptualize so many aspects of their commentary in terms of storytelling, and how these authors prioritize storytelling as the fundamental element of writing science fiction are even more significant when considered in terms of the nature of the interviews themselves. The interviews were described to the respondents in terms of how they see science fiction, themselves, and their writing as part of the space

between science and society. Prior to the process of securing and conducting the interviews, the general expectation was that these authors would take that description of the study as a starting point to discuss elements of science communication, science education, science popularization, or comment upon all of the ways that science fiction might inspire and shape the future of the scientific enterprise. Those things are apparent in these interviews, but they are always secondary to storytelling, or they are situated and discussed in the context of storytelling. These authors repeatedly and consistently engage the prompts and questions from the perspective of storytelling and their roles as professional storytellers.

The second prompt includes “when telling a story,” so it’s not that surprising that storytelling is at least part of what the authors discuss in response to that prompt, but storytelling almost always comes up in the origin stories that follow from the first prompt. That prompt was expected to serve as an open-ended and self-defined equivalent of the demographic questions that are used in survey research, and it was in part intended to give the respondents the opportunity to at least partially define or frame the interview in terms of their perspective. With storytelling so prominent before story is mentioned in a prompt, it is a stretch to argue that the respondents framing so much of their commentary in terms of storytelling is simply an artefact of that element of the survey instrument. It also seems clear in these interviews that there is significant depth of thought behind the way the authors are directly and indirectly referencing storytelling as the essential element of their profession. The conceptual sophistication inherent in their discussions of storytelling and the way they so consistently answer questions in terms of storytelling are simply not something that can be dismissed as a reaction to the wording of that second prompt. Storytelling is not a new or casual element of how they conceptualize themselves, their roles, and the nature of science fiction. It is essential.

THE PROFESSIONAL STORYTELLER

The idea that these authors understand themselves as part of a storytelling profession arises both directly, as in Connie Willis’s comment, and indirectly when they discuss writing science fiction as a creative or artistic profession. Jack McDevitt most clearly states the way he believes that this self-conceptualization as a storyteller is essential to his very nature as a person. “I don’t think of myself in those terms (An agent between science and society). I think of myself as an entertainer.” However, it is a common element in the discussions of how these authors conceptualize their self-identity, and it arises repeatedly in the origin stories the authors tell. Kevin J. Anderson discusses both how creating and telling stories was part of his nature even before he

could read and write, as well as how the shift from technical writer to fiction allowed him to embrace this aspect of his nature. Steven Barnes talks about how his family history led him to try to deny the creative and artistic aspects of what he would probably call his soul and avoid writing for several years. Similar to Anderson, Charles Stross talks about trying to write stories at an early age, and he discusses his effort to force himself into a different profession only to find the pull back to the creative endeavor of telling science fiction stories to be irresistible. Connie Willis's statement that the origin stories of writers are always the same is probably taking it a bit too far in terms of this assertion of a common self-conceptualization as a storyteller, but most of the origin stories offered by these authors read like variations on a theme of being pulled or driven into the profession by the fact that storytelling was in some way a defining aspect of their very nature. Further, as Nancy Kress's discussion of music suggests, this creative drive is specific to storytelling. It is not just a generalized artistic or creative element of how they conceive of themselves. They discover the artist in storytelling. As Stephan R. Donaldson put it, "I had, in a manner of speaking, established myself as a professional writer, but also having established myself within myself, in terms of how I wanted to tell stories."

The commentary on the profession of writing science fiction is related to how these authors conceive of themselves as professional storytellers, and there are two aspects of that which are critical, particularly in terms of the concept of a science fiction ecosystem. The first of these elements is the simple fact that they conceive of writing science fiction as a profession. The dynamics of the profession need to be part of any effort to create an initial sketch that describes the science fiction ecosystem, and a great deal of observation from outside of these interviews needs to be added in order to do that; the profession of science fiction is discussed as part of the conclusion. However, the second aspect of conceiving writing science fiction as a profession is the fact that they consider writing science fiction as a career.

The essential nature of storytelling to the profession is particularly evident in the origin stories that discuss a shift into science fiction writing from an earlier career or career path. Nowhere is this more apparent than in Kevin J. Anderson's interview. Storytelling is only real difference between serving as a technical writer who produces the public information for a scientific research institution and writing science fiction. To conceive of the move from one to the other as a monumental career change, which Kevin clearly did, is to define the profession of science fiction writing as first and foremost, storytelling. Similarly, the other career shifts that are discussed, such as the way Charles Stross discusses his move from pharmacy to science fiction author, reinforce both the conceptualization of writing as a profession and the centrality of storytelling to the very essence of that profession. Writing as

a storytelling profession is also clear in the paths that brought most of these authors into writing science fiction.

As professionals, writing becomes a matter of balancing the functional pragmatics of earning a living against the ideals of the storyteller. This provides an indication that some reference to the economics of fiction writing must be part of the sketch of the ecosystem, but it is also an indication of how storytelling is essential to the way they conceptualize themselves and their primary roles as professionals.

Ideally, the interviews would have included a question or a prompt that directed the respondents to define the profession or discuss the essential elements of the profession. This would have provided a more definitive indication that they equate the profession with storytelling, but it's not clear that the value of soliciting a response directly on that point could have been anticipated. The intent of this study was to explore, in the most unstructured manner possible, how the authors conceived of the genre and their roles in the social and communicative space between science and society, and one of the key things discovered in these undirected responses was that centrality of storytelling. While this leaves some room for interpretation in terms of the definition of the profession, the fact that comments in this regard were not derived from a direct query about how they define the profession would tend to reinforce the argument that this is natural to the way they conceptualize it.

OTHER COMMUNICATIVE ROLES AS SECONDARY OR INCIDENTAL TO STORYTELLING

Reinforcing the primacy of storytelling are the comments indicating that the other things that these writers do as science fiction authors, or the other things they try to accomplish with their writing are secondary to storytelling or are a result of storytelling. For the authors who took the "Teaching moment" prompt in terms of science education, this could almost be the theme describing their responses. Rebecca Moesta's comment was the clearest and most direct expression of this sentiment. "When I'm writing, it's not about teaching. It's about stories and characters." Or Simon Morden's, "When I talk at conventions and things like that, I stick pretty solidly in the 'I am teaching you mode.' But when I'm in storytelling mode, that goes away." Spread throughout the interviews are several variations on Joe Haldeman's, "It (science) has to be worked into the warp and weave of the story. Which actually leads you to, at least subconsciously, setting up situations where the science needs to be explained in order for the characters to drive the plot."

Joe Haldeman's comment captures both the way so many of the points being are framed in terms of storytelling and the way the science education role of

science fiction is subservient to the act of telling the story. That idea that these other things that science fiction might accomplish are secondary or incidental to storytelling is reinforced when Haldeman later talks about science fiction's role in popularizing science as part of the response to the between science and society prompt. "To what extent is science fiction useful in getting young people interested in science? And that's something I, as an author, would back away from doing directly. It either works or it doesn't work, and I think it works best in terms of how good the story is rather than whether it is intended to spur interest." Connie Willis is even more forceful on that point that education is not the goal or the point. "One thing I am firmly against is that periodically somebody in science fiction will say 'well kids need to know more about a, b, or c and so I'm going to write a series of books the purpose of which will be to educate them, to teach them that science is good or make them want to be scientists.' I'm sorry, no, those aren't worthy goals for fiction."

STORYTELLING AND THE DEPICTION OF THE SCIENTIST

A second way in which it is made clear that storytelling is essential to the way these writers conceptualize everything about writing science fiction is the way they employ storytelling as a conceptual framework for describing or explaining their actions, choices, or intentions when they write. Every single discussion of scientists, whether it is in regard to how they are constructed in science fiction texts, or how these authors interact with scientists, is couched in terms of storytelling. This is primarily seen in the constant reference to scientists as characters. As Brenda Cooper put it, "Characters are characters, not real people and that's as much the same for scientists as it is for any other profession." Similarly Rebecca Moesta said, "I tend to approach characters the same whether they are scientists or not," and Robert J. Sawyer said, "I don't think the scientists are any different than any of the other characters" and Melinda Snodgrass repeated that basic answer with "I would like to think that I don't compromise. I would like to think that my scientists are really reasonable and realistic characters." Eric Flint said much the same thing with, "Your scientist as a character is going to be an impressionistic sketch of a real scientist. I don't find it to be a problem. It's just a question of if you do it well enough." While authors often went on to discuss details about scientists as characters and what made them interesting, and some discussed what kinds of narrative roles those characters played in stories, it was clear that they were thinking and explaining things in terms of storytelling.

The assertion that scientists were treated the same as other professionals in the way they were created and used as characters is interesting in its

own right. Steven Barnes's discussion of developing and writing characters with specialized knowledge, regardless of the nature of that specialization, is particularly interesting, but it is the seemingly universal trend to discuss scientists in terms of the storytelling element of character that is relevant to the point on storytelling as the essence of science fiction.

It is possible that the second prompt drove these answers to converge on character. The prompt was:

Are there any times where you've had to compromise the reality of science or the scientist in order to tell the story?

What remains an open and at the moment unanswerable question is whether "to tell the story" would lead someone who doesn't think of themselves as a professional storyteller to frame their response to this question in terms of a scientist as a character. If storytelling was only prominent in these interviews in the way they discuss scientists as characters, this would be a significant concern. However, both the extent and the variety of ways that these authors talk about story or frame their comments in terms of storytelling prior to this prompt tend to support the claim that storytelling is central to the way they conceive of themselves and their profession.

STORYTELLING AS THE FEATURE, NOT THE FLAW

The extent to which storytelling shapes the way these authors conceive of and engage so many aspects of the profession is made abundantly clear in these interviews. It extends all of the way to the point to their most basic conceptualizations of who they are.

For this mapping exercise, the ubiquity of storytelling as a fundament of who these people are, what their profession is about, and what they do provides a simple way to define the boundary between science fiction and other texts or communicative acts that exist in the space between science and society. Science fiction is, first and foremost, a creative profession that entertains an audience through storytelling. While there are other factors related to any definition of science fiction that might be employed, it is safe to say that these authors consider this to be a necessary condition and it must be present for something to be considered science fiction. Essays, documentaries, educational texts, news, research articles, lectures, and a whole host of other things might occupy this space, and many of them might well be at least partially meant to entertain, but it is only in the creative act of storytelling that something becomes science fiction.

Perhaps more importantly, storytelling is not just a necessary condition; it is the fundamental element of science fiction. These authors are abundantly clear that every other aspect of science fiction exists or occurs within the context of storytelling. To return to the sporting metaphor, storytelling not only defines the boundaries of the field of play but also defines the nature of the game to be played upon that field.

This suggests that every subject of academic interest in regard to science fiction, from representations of science and scientists to the engagement of contentious social issues in the genre, occurs within the context of an author working within the compelling and definitional imperative to tell a story. Reference to this crucial aspect of science fiction, however, can be difficult to find in the academic research that examines science fiction. In the study of the news media, almost everything about the examination of that subject is built from the fact that journalists are first and foremost reporters trying to earn a living by covering events of immediate relevance to their audience, and news outlets are striving to sustain an audience by providing that service. However, there is no equivalent recognition in the study of science fiction with the fact that these authors are trying to earn a living as professional storytellers engaging an audience through their fiction. Presumably it can be found somewhere within the literature, and it is reasonable to expect that it can be considered inferred or implied in many analyses, but it is certainly not a central element in the same way that reporting current affairs is treated in the study of the news.

It remains to be determined how significant this might be, and there is a great deal of room for debate on the issue, but it does seem clear that there is a need to discuss and debate how the conscious engagement with the concept of the professional and storyteller elements of science fiction authorship could impact academic research going forward, and perhaps how it might better frame our understanding of previous scholarship.

This also places the question of how someone survives as a professional storyteller as the central dynamic in any sketch of the science fiction ecosystem. Relationships between the author and publishers or other aspects of the industry, engagement with fans, social media efforts, finding a niche or brand of story, and all the rest are driven by the fundamental need to earn a living as a storytelling professional. There is not much in these interviews that addresses that question, but it is clearly something that would be critical for moving from a sketch to a model of the ecosystem.

Chapter 28

Science as the Rules of the Game

Star Wars is not Science Fiction.

—Robert J. Sawyer

Robert J. Sawyer's explanation for why *Star Wars* (Lucas 1977) is not science fiction, and why calling it science fiction is problematic for the genre, is notable for both what it says about how these writers think about the science they include in their storytelling and the depth and extent of that thought. Sawyer's commentary is indicative of a variety of statements indicating that a forthright engagement with science as an institution, process, and/or body of knowledge not only is an integral part of their storytelling but is what differentiates science fiction from other forms of storytelling. Regardless of the marketing label that a publisher or studio might place upon a novel, TV show, or film, it is not science fiction unless that forthright engagement with science is essential to some critical aspect of the story being told.

Forthright is used to describe how these authors use science in order to indicate that there is an intellectual honesty involved, but that honesty does not translate into a strict adherence to technically and precisely accurate depictions of science. What is made clear by the way these writers discuss science in these interviews is that regardless of all else, storytelling is paramount and the various ways that these authors employ science are all intended to contribute to the imperative to entertain through storytelling. To return to the sporting analogy, if storytelling defines the field of play, a forthright engagement with science sets the most fundamental rules of the game. Those rules are often bent and sometimes broken, but at a fundamental level, the authors are clearly committed to respecting the way the rules of science define the nature of the storytelling game.

Exactly what is meant by a forthright engagement with science and how science is employed as an essential part of storytelling vary in countless ways. Those variations offer an interesting framework for charting this space, but using that to organize an exploration of how science sets the rules should not detract from the fact that there is a clear commonality in the way that these authors endeavor to respect science in ways that both enables and limits the stories that can be told.

PLAUSIBLE BUT NOT NECESSARILY ACCURATE

Most of these authors are quite clear about how they strive to respect the science involved in their stories while still acknowledging that storytelling will often require deviations from the accurate depiction of scientific reality. Perhaps the most common and most obvious example is in how the vastness of space makes Faster Than Light (FTL) travel a storytelling necessity. As Kevin J. Anderson put it, “unless you want a story where it takes 700 years to get from one planet to another you have to wave your hands and say look I know this doesn't work but for the purposes of my story, I have to have starships that regularly go from planet to planet. If they can't, you don't have a galactic empire.” In this way, FTL is an example of what David Gerrold was referring to when he talked about the generally accepted conceit of the McGuffin.

“McGuffin” is a term often used in screenwriting to talk about a plot device that accomplishes this kind of handwaving, and, in this context, it encapsulates the idea that it's accepted that a science fiction author might employ a single or sometimes two bits of scientific sleight of hand in order to tell the story. As David Brin put it, “with hyperdrives and those kinds of things, you can make a declaration that hyperdrive is the given, now I'm going to respect all the laws of physics except for that, but it's still exactly what I would call hard science fiction.” Kevin J. Anderson said something similar about FTL travel and FTL communication, referring to it as handwaving “for the purposes of storytelling.” However, it is significant that Anderson went on at length about doing everything possible to keep that handwaving within the bounds of what might be scientifically plausible. In the example he offered from his *Saga of the Seven Suns* (Anderson 2003), Anderson talked about the hints from quantum mechanics that could be taken to suggest that FTL might someday be possible. When combined with his comment on the variety of commonplace things that would have been unimaginable a few centuries ago, it is clear that he knows that he is working out at the extreme fringes of plausibility while also pointing out that for some things, such as FTL transportation or communication, that window of plausibility can be stretched quite wide. So even in the context of handwaving or employing a McGuffin,

many of these authors strive to stay within the bounds of scientific plausibility as much as possible.

Anderson's point about the likelihood that our future will include all sorts of things that are currently unimaginable connects to a second aspect that makes plausibility rather than accuracy the ideal that guides these authors. Science fiction is often called speculative fiction because it is overwhelmingly about what is possible, not what is, and that act of exploring the possible inevitably includes some presumptions or assumptions about unknowns and some of these will inevitably be wrong or push the boundaries of plausibility. In fact, in some cases, the authors are hoping that their predictions of what is possible will be proven wrong. Vernor Vinge summed it up with a reference to a well-known comment made by one of the Grand Masters of science fiction: "You've probably heard Ray Bradbury's comment about whether science fiction predicts the future. Paraphrasing, he said that science fiction is really not about predicting the future. Often it's written to prevent it." David Brin discussed it in terms of dystopian science fiction as an attempt at creating a self-preventing prophesy, where the fiction exposing a horror that is scientifically, technically, or socially plausible enables society to take steps to avoid it. In this way plausibility, not accuracy, is again the point of emphasis.

This speculative aspect of science fiction adds a second, and more subtle, way that these authors knowingly depart from an accurate depiction of scientific reality, and it is pervasive. Even when these authors are devoted to a fastidious commitment to accurately depicting the science used in their novels, they are often talking about extremely speculative projections of theoretical possibilities rather than the accurate representation of scientific knowledge. When Simon Morden offered this example from one of his stories, he both represented an unquestionable commitment to respecting the science in his storytelling, and a clear example of an extreme extrapolation of the plausible, rather than an accurate, representation of the current state of scientific knowledge. "So, I got to his point in the middle of the story and I thought, I've got to slow down a spaceship that's moving one kilometre a second slower than the speed of light, without turning it around, how do I do this? And I thought, if I cannot come up with a way of slowing the thing down without turning it around, I am simply going to have to abandon this story."

It is telling that Morden was willing to abandon a story if he could not find a scientifically plausible way for his character to escape the situation he was in, but it is also clear that the emphasis has to be on what is imagined to be scientifically plausible, not an accurate representation of scientific reality. Humanity has never accelerated a spacecraft beyond the smallest fraction of the speed of light and our current state of knowledge offers no realistic path to the technology needed to even create that critical aspect in the scenario of the story. While it is theoretically plausible that a ship could be accelerated

to nearly the speed of light, the energy needed is well beyond what the entire human race has produced, in total, throughout the entirety of its existence, and there is nothing in our current understanding of science that would enable us to engineer a way to accomplish that feat.

Even the authors that primarily write fantasy, such as Ian Irvine, reinforce the idea of telling stories that are forthright in their engagement with scientific plausibility, but Irvine adds one additional aspect of distortion in the name of storytelling that might otherwise be easy to overlook. As he put it, “I don’t compromise the science, but I do have to work hard as a storyteller to reduce some of it into elements that are going to be comprehensible in the context of a story that’s popular fiction.” Such simplification, particularly if it involves something as theoretically complex and inherently incomprehensible as quantum mechanics or cosmology, is another act of storytelling where a storytelling imperative might introduce compromises or inaccuracies in the science involved.

The comments on handwaving and McGuffins reinforce the conclusion that storytelling is always the first and most fundamental consideration for these authors, but the most fundamental rule after that consideration is to strive to respect the plausibility of that science. Taking the next step into the question of how science sets the rules of the storytelling game, the broader context of Irvine’s comment is also informative in the way it connects to the wide varieties of ways, beyond that most basic rule of plausibility, that science is employed as an essential storytelling element. Irvine talks about how he used his scientific background in geography and geology to create a scientifically plausible map as the conceptual starting point for his first fantasy epic. So even in his fantasy work, he’s using science to quite literally set the stage for his story. While that stays unmentioned in the background of Irvine’s novels, a more overt but similar use of science to set the stage for a story is one of the more common ways that science fiction authors employ plausible projections of science as critical storytelling elements in their novels. That is in sharp contrast to the way that Simon Morden talks about science as the means of solving the problems that confront characters, and it is also in contrast to the way Nancy Kress discusses using science as a metaphor.

Exploring three of the most common ways that science is adds an additional dimension and further detail to the way these authors work with a forthright engagement with science as the defining rule of science fiction storytelling.

STORIES ABOUT THE HUMAN IMPACT OF SCIENCE

Connie Willis sums up what is probably the most common approach to employing science in science fiction storytelling when she says, “People have

the mistaken idea that science fiction is stories about science. It's not. It's stories about the interface between science and human beings, or technology and human beings." Similarly, Jack McDevitt said roughly the same thing and connected it directly to respecting the science involved. "I like to think that I'm not really writing about science. I am writing about people who have unusual experiences as a result of scientific breakthroughs and technology. To do that, you have to keep the science valid." These quotes reflect a variety of other comments in these interviews where the authors talk about storytelling as exploring the human condition or engaging the heart of the reader. Several of the examples and much of the discussion offered by Nancy Kress are focused on positive versus negative representations of science and storytelling, but they again touch on the idea that the story is not about the science, it is about how science affects people. Similarly, Stephen R. Donaldson's comment about storytelling being the only way we can escape from our own skulls reinforces this idea that much of science fiction is not about the science itself, but about its impact on the human condition.

While there are many comments about respecting science as being essential to science fiction, and several of these authors discuss how they conceptualize storytelling in terms of the human impact of science on individuals or society, it is Steven Barnes who gives us the best starting point for linking these two things and interesting enough, it couches his comments in terms of storytelling as playing a game. "You can start from either end. The science says this could happen and then find the story like Larry (Niven) and Jerry (Pournelle), or here's something and here's a plausible mechanism to make it happen so I can tell that story, like I do. It's a game you can play either way, but there's still that need to respect the science."

Combining Barnes's description of his own approach to respecting science, with the fact that he expressly focuses on engaging the nature of humanity with his science fiction, suggests that finding the science to tell the story might be something to look for in the approaches of authors who are writing stories that focus on the human side of science. Are these authors looking for the scientific idea that will give them a plausible mechanism to allow them to tell the story they want, or are they exploring the science and discovering the stories that a discovery or idea might generate?

This is probably not something that can be answered here. There is not a lot of detail in these interviews about how the nature of the writer's engagement with science and stories about the human impact of science might be functionally linked. There was nothing in the design of this research or the interview prompts meant to drill down into this level of detail, so that is not all that surprising, but it is certainly worth further exploration.

Nancy Kress's discussion of cloning, genetic engineering, and her novel *Beggars in Spain* (Kress 1991) provides some indication of the thought she

puts into this issue, particularly in the way she admonishes inexperienced writers for the common presumption that clones will in some way be evil, or that genetic engineering will inevitably cause disasters. The idea of cloning as delayed twinning, and that you would expect the same from a clone that you would from a twin rather than an evil doppelganger, is indicative of this idea that the scientific reality behind ideas needs to be a driving force in exploring the human impact of science or technology.

Taking a step farther back and using some of the things that can be seen in the novels produced by these authors suggests that examining how the universe of the story is constructed, particularly in terms of how they explore secondary and tertiary effects of science or technology, may be the best way to develop a better picture of how respecting the science translates into the rules of the game for stories that first and foremost examine the human impact of science. Those secondary effects of the technology are what Kress explores in *Beggars in Spain*, and it suggests that in these stories where the primary focus is on the human impact of science or technology, the respect for science plays out first in the world-building and that is an area that should be easy to explore. These elite science fiction writers often talk about world-building both as part of the writing process and as part of the storytelling, and it is reasonable to expect that studying what they have said regarding that aspect of writing science fiction will clarify how science sets the rules they use for writing.

As an example; to explore this, the follow-on from Kress's comments on *Beggars in Spain* would probably include questions about how she addressed or included the science related to the neurological functions that occur during sleep, including the studies of sleep deprivation and how that affects cognition and behavior. How did she include that in the storytelling universe she built? Did she find additional story elements or plot complications in that science?

A high priority needs to be placed upon exploring this further as part of mapping and understanding this space because this type of story describes so much of science fiction. From Mary Shelly's *Frankenstein* (Shelley 1818) to Ursula K. LeGuin's *Lathe of Heaven* (Le Guin 1969), to Philip K. Dick's *Do Androids Dream of Electric Sheep* (Dick 1968), some of the most iconic novels in the genre are offering precisely this kind of story. However, further exploration of how science is used to build the worlds for these stories is also important because of the role of world-building when science itself is the story.

SCIENCE AS THE STORY

Often, as was the case in Simon Morden's example of the story about a ship near lightspeed, the science itself is the story. In Morden's example, science is both setting the stage for the story and serving as the mechanism for the

protagonist to confront the disruption of the status quo or threats to fundamental values. These stories are sometimes called puzzle-solving science fiction, and the classic works of James White, including novels such as the *Sector General* series (White 1962) and *Lifeboat* (White 1972), provide some of the better examples of type of science fiction storytelling.

Puzzle-solving science fiction is also notable in that not only is the author striving to adhere to the rules laid down by the ideal of offering forthright representations of science, but the characters within the story must also explicitly engage the science and use it as the mechanism for resolving the conflict driving the story. The result is that through the story and actions of the characters, the author has to delve deeply into the details and dynamics of the science and explicitly share those with the reader. The science cannot be left in the background and this makes the forthright engagement with a plausible depiction of science and/or related technologies all the more significant in the storytelling game.

More generally, science can be the story in the way it acts as the disruptor of the status quo, such as when a discovery shifts or threatens the balance of power between characters in the story and initiates the central conflict of the plot. As Gregory Benford noted this is the kind of story about science that he most commonly writes. “Most of my work has been from the point of view of a scientist, confronted with a discovery or situation and it looks at how a scientist thinks about it and deals with it.” An example of just such a novel is *Cosm* (Benford 1998). *Cosm*, along with a novel like Vernor Vinge’s *Across Real Time* (Vinge 1991), is particularly interesting in regard to the discussion of plausibility as the rules of the game and a scientific discovery serving as the disruption of the status quo. In both of these books, the discoveries represent extreme extrapolations of what might be scientifically possible, while the characters still act strictly within the bounds of what is scientifically plausible if those extreme extrapolations turned out to be correct. So not only did these authors project out to something that might be plausible, but they also took it a step further and projected what other scientific possibilities would be likely if that projection turned out to be correct and built those elements into the stories.

At the extreme, such scientific extrapolation of what is plausible can be used to create worlds so fantastic that the exploration and explanation of the place or the time is in fact the story being told. Larry Niven is the most obvious exemplar of a writer who commonly offers those kinds of world-exploration stories, with *Ringworld* (Niven 1970), *Smoke Ring* (Niven 1987), and the *Bowl of Heaven* (Benford and Niven 2012) as the standout examples, but there are countless others, such as Benford and Brin’s *Heart of the Comet* (Benford and Brin 1986), Arthur C. Clarke’s *Rendezvous with Rama* (Clarke 1973), Neil Stephenson’s *Diamond Age* (Stephenson 1995), and Kim Stanley Robinson’s *Red Mars* (Robinson 1992). A set of novels that probably deserves special

mention is Ben Bova's tour of the solar system (Bova 1992). The way Bova uses those books to explore the science, engineering, and pragmatics related to colonizing and terraforming the solar system is notable in both scope and detail.

SCIENCE AND THE PATH TO THE FUTURE

Bova's tour of the solar system novels are also notable in the way those novels employ the extrapolation of scientific principles and expectations as a means of constructing a possible future that the stories explore. The science and technology related to colonizing our immediate planetary neighborhood define most of critical elements of that future, and through that the science is the centerpiece of those stories. However, that act of extrapolation must also engage the broader social effects of the science in ways that will tend to differentiate it from novels and stories where the science itself is the story. As Bova put it "all the stories that are written show possible realities, potential realities. It gives the readers a chance to look at things that might be and maybe make some choices about where you want to go and build the future."

The tour of the solar system novels quite clearly straddle any line that might be drawn to distinguish between stories that explore a path to the future and different types of science fiction stories, and that is something of a norm. Many, if not most, of the stories written by these authors transcend any typological boundaries that might be proposed within the forthright engagement with science. Thus, it is probably best to think in terms of relative levels of emphasis on the human impact of science, science as the story, science and the path to the future, and other ways we might organize a discussion of the engagement of science in storytelling. Though it is useful for discussion, it is probably misleading to treat any set of organizing concepts that might be derived as mutually exclusive categories.

This category of respecting science through plausible paths into the future, however, is particularly valuable as a touchstone or focusing concept here because of the way these authors so often describe things in terms of using science and history to chart a path into the future. David Brin goes on at some length in this regard.

Hard science fiction is the stuff that tries for Einstein's gedanken experiment and trying to work out what might actually be a path of human destiny. In order to that you have to bring in not just science and technology, but also some instinct for the way human psychology and all that is involved. But above all, the thing that transfixes all science fiction authors is history. If we think about it, that is the great drama, that should transfix anybody. This panoply of horrible mistakes made by our ancestors. This incredible tale of three steps forward, two

steps back and five to the side. That even our most well-meaning ancestors committed the most horrible crimes because of the assumptions of their time. The poignancy of history is the great story and what does science fiction do? Science fiction is not about the technology, it is about the science. It is about the process of change. It is about extending this incredible story of history through these d thought experiments to extrapolate possible extensions of that drama into the future. Or possible alternative paths through alternate histories.

Nancy Kress described this kind of approach to scientific storytelling as “A rehearsal for possible futures. It’s about possible impacts of technology” and it is also common in the way examples are presented, such as the one offered by Connie Willis. “What I did was I went 20 years in the future after this technology had been in existence and I tried to show through its impact through different generations of women.” David Gerrold discussed it in terms of what he thought the genre was trying to accomplish through its stories. “Science fiction functions as the research and development division of the human race. We are imagining possibilities. We are designing and building the future that we’re going to live in. We’re the dreamers, the scientists are the theorists, and engineers are the builders.” There is also Charles Stross’s comment on plausible futures. “It (science fiction) attempts to explore the human condition under circumstances that do not apply but plausibly could apply given our understanding of the universe.”

Even when the comments note how poor science fiction can be about predicting the future, such as Ben Bova’s broken clock analogy, there is an acknowledgment that building scientifically plausible futures is one of the common ways that science is employed in writing science fiction.

In these criticisms, such as S. M. Sterling’s comment on how poor science fiction authors have been on projecting the future of political and social trends and how that relates to the S-curve model of cascading then stalling trends, it is also made clear that science is not just referring to rockets and lasers. There are indications in some of the more general comments on science and the nature of science that science is broadly conceived to encompass many, if not most, areas with a tradition of methodical research that draws testable (contestable?) conclusions. Comments on psychology, history, sociology, politics, and even philosophy, framed in terms similar to the way projections of science are discussed, all reflect this idea.

MULTIPLE APPLICATIONS OF SCIENCE AS THE NORM

These three typologies for how science is employed in science fiction are neither sharply defined nor are they mutually exclusive categories. Further, as

was indicated in the comments on Ben Bova's tour of the solar system collection of novels, it is common for stories to engage science in several different ways simultaneously. In fact, regardless of the categories or typologies used, most science fiction stories, particularly novels, are likely to include a wide variety of plausible and forthright depictions, projections, and other engagements of science.

What these descriptive typologies provide is a framework for one possible way that the "terrain" resulting from the forthright engagement of science in science fiction can be described and discussed. In terms of charting the space of science fiction, it also provides a way of showing how seemingly disparate approaches, such as the intensely social and philosophical works of Ursula K. LeGuin and the highly technical world-building works of Larry Niven, can both be considered as exemplars of excellence in the genre. Both are grand masters of the genre, but it is difficult to imagine two writers who could be more different. LeGuin is often held up as an example of how science fiction explores the human and social implications of science and scientifically plausible projections of the future, while Steven Barnes's reference to "The way Larry does it" when he talked about how to engage science represents how Larry Niven is considered to be one of the best there is when it comes to employing science as the story.

These three categories—the human impact of science, science as the story, and projections of plausible futures—were inductively derived from the commentary in these interviews, but they also happen to offer a reasonable way to describe the key ways that authors and individual works have exemplified the best in science fiction, and this is an example of another way that the voices of these authors, or in fact the voices of the wider science fiction community, can and probably should be respected in the academic study of the genre. No matter how the genre is described or defined, the conceptual framework used to offer that description needs to be based upon what those working in the genre and engaged with the science fiction identify as not only the boundaries of genre, but also the works and individuals that embody excellence within those boundaries. Both LeGuin and Niven have earned the designation of Grand Master, which is a rare and coveted honor bestowed by their fellow writers through Science Fiction and Fantasy Writers of America (SFWA). Similarly, the Nebula is an SFWA award and there are also the Hugo Awards, which are nominated and voted upon by members of the current and previous World Science Fiction Conventions. Both the Hugo and Nebula awards are given annually to works deemed to be the best of the given year, and, as such, they provide a record of what those engaged with the genre treasure.

LeGuin's works focus on the human impact of plausible projections of science; Niven's best works employ science as the story by literally building fantastic but plausible worlds; and authors such as Isaac Asimov, Robert

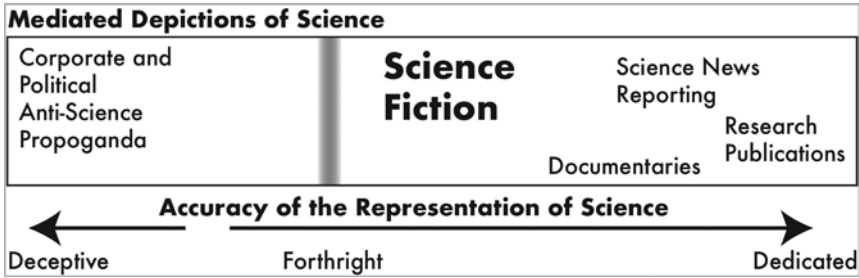


Figure 28.1 Mediated Depictions of Science. Source: Created by Author.

Heinlein, and Gene Roddenberry are frequently described as greats in the genre in terms of their projections of where science would take us in the future. Most of the Hugo- and Nebula-winning fiction, as well as the nominees, can be sorted in terms of excelling primarily within one of these three categories: the human impact of science, science as the story, and plausible projections of the future. Again, no claim is being made that this is the correct or ideal conceptual framework to be applied. However, if a description or definition of what is essential to science fiction does not capture both LeGuin and Niven, then it is probably not capturing the essence and nature of the genre.

Returning to the fundamental point offered at the introduction of the chapter, that a forthright engagement with science is a defining element of science fiction, the rough outlines of a way to visualize the space of science fiction begin to emerge. Mediated texts that engage science as a central or critical element can be arranged along a spectrum representing the degree of commitment to the accuracy of their representations of science. This is visualized in Figure 28.1.

The far left of that spectrum stretches into the negative reaches of whatever scale might be applied, where deceitful and willfully ignorant texts, such as anti-climate change propaganda, flat-earther screeds, and the now-infamous fraudulent study linking vaccinations to autism would reside. The point along the scale where the depictions of science improve to the point where they are considered forthright is open to debate, and in fact will probably always be indistinct and contested, but science fiction would be to the right of that transition. Continuing up the scale would lead to science educational texts such as documentaries, then textbooks and science news reporting, and at the extreme reaches of a scale representing a commitment to scientific accuracy would be peer-reviewed research publications.

As argued in the previous chapter, storytelling is the critical attribute that distinguishes science fiction from other categories of texts in this representation of mediated depictions of science. Adding storytelling as another

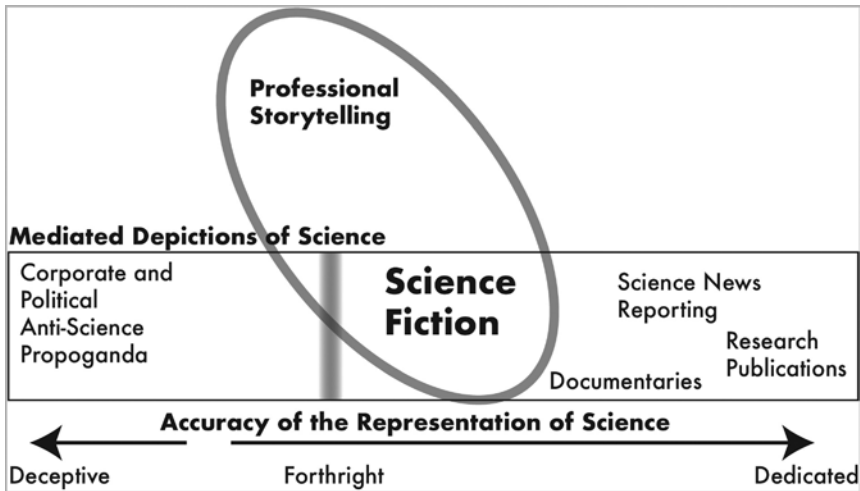


Figure 28.2 Storytelling as Essential to Science Fiction. *Source:* Created by Author.

boundary condition defining science fiction produces something that looks roughly like a Venn diagram defining the boundaries of what is considered science fiction. The different ways that science is engaged in science fiction would then represent the terrain within those boundary conditions, as depicted in Figure 28.2.

Science fiction is a mediated representation of science, where the accuracy of the depiction of science is at least forthright and the primary intent of the text is to entertain through storytelling. Like the threshold marking the forthright depiction of science, storytelling is not going to be an absolute and exclusive distinction between science fiction and other texts that offer depictions of science. Documentaries and to some extent news reporting of science will often include some storytelling elements, but in both cases, entertaining through storytelling is not the primary purpose of the texts that are created.

There is one additional dimension that needs to be added to this diagram before it can be used to sketch the science fiction ecosystem and discuss how it can serve as a depiction of the space of science fiction. However, the way this description relates to academic definitions of the genre offers a clear opportunity for a clear, concrete, and potentially valuable way to bring the voices and perspectives of these authors into the academic engagement of the genre.

Chapter 29

The Science Fiction Community and a Sketch of the Science Fiction Ecosystem

Part of the reason science fiction endures like it does is because the loyalty of its fans allows it to work on a different metric than other genres.

—Robert J. Sawyer

Given that these interviews were introduced to these authors as an inquiry into their role linking science fiction, science, and society, along with the nature of the prompts used in conducting the interviews, it is probably unsurprising that there is only a handful of comments about the science fiction community and even fewer that can be directly applied to sketching out the business and other demands that are placed upon these authors. Understanding the dynamics of surviving as a professional writer working in the genre is a critical element in such an ecosystem, and there just isn't a great deal on that point to be found in these interviews. That is not surprising. Prior to conducting these interviews, there was no reason to expect that the authors would be as motivated in the way that they were by the opportunity to inject their own voices into the academic discussions of science fiction. There was also no way to foresee that the best way to respect that and interject their voices into the academic milieu was to use their comments to sketch the outlines of the science fiction ecosystem as a means of providing a conceptual contextualization for academics who might wish to rethink or adjust how they engage science fiction texts and science fiction as a genre.

If any of the prompts had directed the authors to reflect upon the professional necessities related to surviving as a working professional, there is little doubt that a great number of detailed comments and anecdotes would have been offered, but that was not something that appeared relevant before the

research commenced. As it is, there are only a few comments on the business side of the profession; when combined with a more general understanding of professional norms, however, they do indicate at least one defining aspect of that business side of the science fiction ecosystem and even though it is only a starting point for that aspect of this sketch, it still offers something conceptually valuable for this effort.

Expanding the base of information to sources beyond just the content of these interviews doesn't help much. Since its inception, *Foundation* has published a series of essays entitled *The Profession of Science Fiction*, a collection of which have been published as an edited volume (Jakubowski and James 1992). On the surface, the rarity of citations to those articles in the academic literature might seem to indicate a disdain for the need to consider the profession and its demands, but the reality is that, aside from some extraordinarily grim autobiographical comments by some golden age writers, there is not a great deal of useful information in those essays about what it takes to survive as a professional. The topics of the essays range from "where do ideas come from," to a confessional about time spent in a mental institution, and there seems to be an emphasis on doing something fun, unique, or entertaining with the invitation to contribute to the series. The essays tend to succeed on that point. They are an interesting read and, undoubtedly, there are potentially useful comments that might add to an understanding of the science fiction ecosystem in them. However, whatever wheat there might be is buried within a great deal of chaff. More importantly, it is clear that some sort of initial understanding or framework is needed to find what can be applied to the concept of an ecosystem from those essays.

While the dreaded cliché of "further study is indicated" is probably justified here, there are a few comments, and some indications from how this study was conducted that indicate one dimension where science fiction is probably different from other genres, if not unique.

One thing that is commonly thought of as essential to surviving as a science fiction author is actively interacting with the fandom, the intensely engaged and dedicated portions of the science fiction community. While there is not a great deal that is said on this point in the interviews, what is said suggests just how important this is in terms of the business side of the profession. Robert J. Sawyer mentions the critical role that dedicated fans play in the commercial aspects of surviving as a science fiction author. "Even though only maybe 1 in 5 people walking into a bookstore are going to wander over to the science fiction section, they buy the books, and you can make a living. You will never have Dan Brown numbers, but you can make it. Same with films and TV. Lower budget stuff can work and does work." By noting that he was an exception, David Brin points out how most authors understand how important it is to engage the most dedicated strata

of the fan base even before entering the profession. “Many science fiction authors, certainly not all, but many, came into the field having been science fiction fans. They attended science fiction conventions and had met some of their favourite authors. Knowing about the Hugo Awards and things like that . . . I attended and was quite struck by the community. It was an amazing community of interests.”

Nancy Kress and Simon Morden both mention their participation in these conventions in ways that indicate that such engagement is common enough that they have consciously developed norms for the way they participate in these conventions and how they interact with these fans. Additionally, there is the simple fact that it was possible to interview so many of these elite authors at just one of these science fiction conventions. All of this suggests that even though it is not frequently mentioned in these interviews, direct audience engagement needs to be part of any description of the science fiction ecosystem.

Clearly a great deal of additional research into the business aspects of science fiction will be needed, but the value of this point is in how it might distinguish the business aspects science fiction from those of other literary and popular culture genres. While there are now other genres that have conventions for fans, and the conventions for pop culture genres such as comics and manga can be huge events, the conventions and other acts of direct engagement with the most dedicated fans have always been essential to the business of science fiction. The first World Science Fiction Convention was held in 1939 in New York, a quarter century before the first Comicon and a simple internet search will reveal that there are well over 100 science fiction conventions occurring annually around the globe. So, in Figure 29.1 direct audience engagement is added as an element that has a unique place in the business aspect of the science fiction, with the caveat that it is just the starting point in developing an understanding of the ecosystem of science fiction.

It cannot be said often enough that this is only the simplest of sketches, and will take further, focused study to delve into the details and dynamics of how the long-standing tradition of conferences and other forms of direct audience engagement are part of surviving as a professional science fiction storyteller. Further, these interviews really do not provide any basis for even speculating upon how it might shape the ecosystem and shape, influence, enable, or limit the storytelling found in the texts that these authors produce. However, acknowledging that it is, and for all extents and purposes always has been, an essential part of the genre is a critical step in understanding the ecosystem. The business end of science fiction centers around this engagement, and at least a few of the authors derive a significant portion of their income from their involvement in conventions and selling their work at conventions.

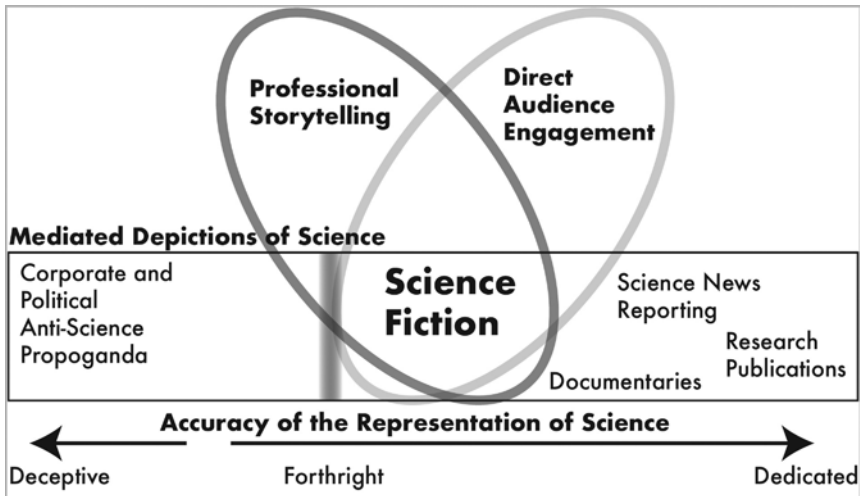


Figure 29.1 Sketch of the Science Fiction Ecosystem. *Source:* Created by Author.

HOW THE ECOSYSTEM MIGHT MATTER

There are two critical ways that the ecosystem, even in the barebones form as it is sketched out here, might enhance the academic engagement with the genre. The first is the myriad of ways that the understanding of the nature of the genre and their place in it impacts the priorities authors place upon different facets of what they are trying to do. Everything about the genre and about their writing is conceptualized in terms of storytelling, and everything else is secondary to, or a result of, that imperative to first and foremost tell a story. This includes many things, such as depictions of science or the scientist, that are of great interest to academics. Engaging science in a forthright, plausible, and meaningful way is one of the rules they accept as part of storytelling in the genre, and those two elements form the pillars of the genre, with the engagement of science just as much an idealized element as the literary nature of the stories being told.

The second way that the science fiction ecosystem might matter is in the idea that the authors working in that space will constantly be engaged in the struggle to balance converging forces or imperatives that are driven by the need to survive in that ecosystem. In the study of the news media this is a critical aspect of understanding the choices, dynamics, constraints, and function of both journalists and news organizations. Journalists must always temper the ideals of journalism and news values against time constraints. They must balance the value of reporting scandal against the need to sustain access to sources. They must fulfil the roles and duties assigned by the news

organization while still striving to stand out in the competition with other journalists. News organizations must balance the qualities of the news that attracts their audience with the costs of producing it. They must balance the influence of elites on the content of the news with their social role of acting as a watchdog on those elites. In these and many other ways the ecosystem of the news is considered essential for studying the actors within it as well as the texts they produce.

For science fiction authors, in addition to the factors that apply to all writers, they must balance the demands of the fandom. Most obviously, as indicated in the discussion of firewalls and the logistics of arranging these interviews, there is a time management issue related to expectations of direct engagement with consumers of the genre. As some of the better-known authors made clear in the discussions of when and where we might be able to conduct the interviews for this study, the sheer number of conventions they feel the need to attend and the quantity of invitations to participate in events at those conventions becomes a challenge. Many of them not only have to limit the number of conventions they attend, they also have to think strategically in their choice of conventions. David Gerrold mentioned that both travel time and mental recovery time were considerations, but that he also employed a strategy of regularly picking a few smaller conventions that he had not previously attended as a way of creating the opportunity to meet with a new set of fans. With a comment that he normally attends Dragon Con instead of World Con, Kevin J. Anderson noted how his responsibilities as a publisher as well as a writer tended to push him toward larger popular culture conventions over purely science fiction conventions.

Indirectly related to that point, a couple of authors commented on how they wanted to avoid getting caught up in the politics related to the Hugo Awards, which are part of the World Science Fiction Convention. The “puppies” and their effort to hijack the awards was at its peak in 2015, and several authors cited that as their reason for not attending the World Con, or for attending but avoiding being part of the official program. Their concern was usually expressed in terms of accidentally becoming associated with one side of that debate and losing their connection with the fans on the other.

More generally, although it is also only indirectly related to the need to directly engage the most dedicated consumers of the genre, these authors appear to work with an awareness of these particularly engaged readers who attend conventions. There is an implicit but clear reference to the engaged audience that would catch the science being wrong that can be seen in Larry Niven’s comment about writing fantasy being just for fun. “When I write fantasy, I’m just having fun, but when I write science fiction, most of all, I try to get the science right. I don’t want to be caught in that silly space opera that isn’t really science fiction and nothing makes sense.” Stephen R. Donaldson

more directly notes about how he thinks about his readers when he engages the science in his science fiction: “Ultimately, I gave myself permission to make up some things and my job was to make it sound plausible to my readers.” Similarly, Simon Morden makes it clear that he has the most engaged elements of his readership in mind when he writes, “They’re my core readership (scientists), but they really aren’t. I’m pretty sure that my core readership wouldn’t really mind if I skipped the difficult bits of science and just got on with the story. But those people who would be really disappointed in me if I did that, are those people who are the scientists themselves. I feel like I owe it to scientists everywhere to actually do the science.”

While an awareness of the audience is probably a necessary condition for all financially successful artists, science fiction’s long-standing standard of high levels of engagement probably elevate this part of the creative process in ways that is well beyond what is found in other genres. Thus, when David Gerrold talked about the acceptability of McGuffins, when Kevin J. Anderson talks about acceptability of handwaving, when David Brin mentioned positing FTL and then respecting all of the rest of science, those comments might best be interpreted in terms of what those most engaged of readers will accept. And when Charles Stross talks about time travel stories becoming impossible, that comment might best be understood in terms of the evolution in what hard science fiction fans consider plausible or acceptable.

Again there is not enough in these interviews or in the logistics surrounding them to make any definitive statements, but it would be extremely interesting to explore how that relates to Suvin’s notion of cognitive estrangement (Suvin 1972) and the artist, as discussed in the following chapter.

Chapter 30

The Academic Implications of How the Creators of Science Fiction Define Science Fiction

If you think about the function of science fiction, what science fiction means is stories with science as a central element, but what makes science fiction interesting are the way it attempts to understand. One thing science fiction does that other genres don't is have people who are professionals in the ways of finding out about the nature of reality as central to the stories.

—Joe Haldeman

Up until this point, a conscious effort has been made to stay disengaged from the academic study of science fiction. This was particularly an issue in regard to literature studies approaches to the genre because it was that specific academic area of study that raised so many pointed comments from participants. However, that effort to come as close as is possible to simply representing the authors' perspective has also limited references to all of the different areas of research that this study hopes to enhance through that commitment to focus on the authors' perspective. To the extent it is possible, the intent was to try to let the authors' words speak for themselves, and to use the interviews, again to the extent it is possible, to self-frame the subsequent analysis or description of what was said. This was the simplest and most straightforward way to respect the authors' desire to interject their voices into the academic milieu, but it also had the benefit of maximizing the opportunity for academics to subsequently interpret, engage, or use these interviews in a way that best informs their research. While academics don't generally need an invitation to interpret or reinterpret anything from the perspective of their research, the intent was to avoid, again as much as possible, pre-empting any conceptualizations of the content of these interviews by framing them in terms of existing debates in the various fields in which they might prove useful.

As a way of concluding this study without simply dropping a banal comment on how further study is needed, a brief examination of one of the most fundamental questions involved in the academic study of science fiction, the definition of science fiction, is offered as an example of how the comments of these authors might constructively contribute to the study of the genre and the impact of its texts.

Surprisingly, defining science fiction has always been one of the more fraught and contested exercises related to the academic study of the genre. It has produced everything from expansive statements of tautological vagary to extensive debates over linguistic nuance that lead to what can be described as little more than replacing science and fiction with words that are dangerously close to synonyms. There is no shortage of overviews of the academic discussions of, and debates over, the struggle to define science fiction, and these debates have persisted to the point where they are a necessary element of introductory texts (Roberts 2002). However, what even the introductory summaries of the definitional debate make clear is that the scholarly efforts to define science fiction are dominated by perspectives that are external to, and in many ways disconnected from, the creative aesthetics and professional understanding of the genre. What is in short supply are contributions to this discourse from perspectives within the genre, particularly from elite science fiction writers.

Given the long history of academic disdain for science fiction, as discussed in detail by Luckhurst (2005), it should not be surprising that academic efforts to define the genre have suffered from a scarcity of perspectives from within the genre. With prominent scholars integrating elitist denigrations of the genre into their definitions, such as Broderick's claim that a de-emphasis on fine writing must be an essential part of the definition of the science fiction (Broderick 2005), the insulting and inherently hostile nature of such commentary has been part of what has made it difficult for academics to create a sustained and meaningful dialog with science fiction authors. Luckhurst (2005) and others argue that there have been some noticeable improvements in both the academic attitude toward the genre and the relationship with it over the last few decades, and the 1972 establishment of *Foundation* as an academic journal dedicated to reviews of science fiction could be offered as concrete evidence of the history of the effort to drive that change. However, both the practical and intellectual challenges created by that history of hostility should not be underestimated.

While this history of hostility and the limited input from perspectives within the genre may not be the source of the definitional problem, the scarcity of commentary from the creators of science fiction on this point is problematic, and in that regard seeking to expand the contribution from the

authors' perspective is a worthwhile effort regardless of how it might reflect upon this debate. The points of agreement between academics and these writers are just as conceptually valuable as points of contention. As a way of expanding the input from within the genre, the description of science fiction ecosystem that has been inductively derived from interviews is reworked into a definition of the genre and briefly discussed in terms of its potential relevance to the larger academic debate over definition as well as academic engagement with the genre.

FROM DESCRIPTION TO DEFINITION

While no effort was made to encourage these authors to define science fiction in these interviews, at some point, almost all of them spontaneously discussed elements they considered essential to the genre. Some mentioned boundary conditions that they thought distinguished science fiction from other genres. Some of the authors, such as Robert J. Sawyer, even went so far as to offer a full definition and subsequently use that definition to frame significant parts of their commentary. The unprompted nature of those comments is significant in any consideration of how these voices should be considered as relevant to the academic debate. That indicates that these definitional elements, ideas, and concepts are a salient part of the professional perspective for some of the most successful artists contributing to the genre. Further, when combined with the indications of the intellectual investment these authors have independently made in considering the issue of what is and is not science fiction, that salience would seem to indicate that these defining elements are likely to influence the texts these authors create.

Describing science fiction as a mediated representation of science, where the accuracy of the depiction of science is at least forthright and the primary intent of the text is to entertain through storytelling foregrounds the representation of science in ways that are useful to an exploration and description of the conceptual space between science and science fiction. However, from the academic perspective on the study of the genre, how science fiction is differentiated from other texts that depict science is secondary. From the perspective of studying the genre and the texts within it, what separates science fiction from other fictional genres is the primary concern. Reformulating the description derived from these interviews into a definition of the genre that can be used to guide academic research produces the following:

Science Fiction is any text that employs a forthright depiction of plausible science as a critical element in the effort to entertain through storytelling.

STORYTELLING AS THE FOUNDATION

It might seem pedantic to assert that storytelling needs to be a defining element of science fiction as a genre. However, it is important to understand that storytelling is the most fundamental aspect of these authors' creative efforts and that they conceptualize everything else as incidental to or a consequence of telling a story. This assertion is all but universal among these authors. Thus, storytelling must not only be included but also be emphasized as fundamental and including a reference to that in the definition might be critical when a definition of the genre is applied in the study of the implications, effects, or content of the texts produced. When we examine these texts in the context of science education, the fact that story is more fundamental than any educational element is bound to be critical. Similarly, depictions of the scientist, depictions of science as a profession, and commentary on social issues are all secondary to telling an entertaining story and will be compromised before the story is compromised. Connie Williams was particularly clear about this when she said that teaching or any of the other socio-communicative roles that science fiction might play were not worthy goals for a writer. Story, story, story has to come first.

Kevin J. Anderson worked as a technical writer producing publicity material for a large research organization, and he is emphatic about how storytelling distinguishes his science fiction from his earlier work, which was literally focused on creating engaging and educational depictions of science for the public. Thus, any examination of depictions of science in science fiction, or the social effect of those depictions, must take into account that those depictions are secondary to or a result of storytelling. Gregory Benford was one of the more prominent astrophysicists of the twentieth century, and studies of how science fiction depicts the scientist need to acknowledge that even in a novel that he considers to be a thinly veiled biography, he is first and foremost telling a story. Storytelling is what distinguishes his science fiction from all the rest of his writings.

Further, when academic studies examine depictions of science or the scientist in science fiction, or for that matter any of the wide variety of social and communicative roles that science fiction might play, such as science education, those studies are implicitly or sometimes explicitly placing science fiction in among a variety of other forms of mediated depictions of science such as documentaries and educational texts. Storytelling is the primary distinction between science fiction and those other categories of mediated depictions of science, and that needs to be integrated into any implicit or explicit comparison.

Storytelling also defines the nature of the fiction in science fiction in a way that clearly differentiates the distortions, exaggerations, and other forms of

inaccuracy in science fiction from the distortions that might be found in other types of mediated depictions of science, such as the intentional deceit of anti-science political propaganda. Identifying the nature of the fiction of science fiction is also significant in terms of the academic definition of the genre because some of the most prominent academic definitions define the fictional element of science fiction according to other criteria.

STORYTELLING AND ESTRANGEMENT

As a point of comparison, one of the most prominent academic definitions of science fiction is Darko Suvin's (1972), which defines science fiction as the literature of cognitive estrangement. Despite Suvin's extensive discussion, it is not completely clear what Suvin means by the term "cognitive estrangement." Robin Roberts (1993) describes it as "Just another way of restating the phrase that is to be defined, 'science fiction' " with estrangement as fiction and cognition as science. Oddly enough, this is considered to be a virtue by Adam Roberts: "One of the strengths of Suvin's definition is that it seems to embody a certain common-sense tautology, that science fiction is scientific fictionalising" (Roberts 2002, 8). Estrangement is the act of separating the reader from experience or objective representations of reality. Suvin argues that this applies to all forms of fantastic literature, and the distinction between science fiction and fantasy is that science fiction offers, at a minimum, some indication that this unreal universe of the story could be explained as possible.

While Suvin is discussing literature, and in doing so it can be argued that storytelling is implied in this definition of science fiction, storytelling is not inherent to the term "estrangement." The emphasis is on the novum, a strange newness (Suvin 1972, 373), and this emphasis on the novum seems to carry through as central to the discussion of most definitions of science fiction (Roberts 2002) even as they focus on cognitive estrangement as the definition. More generally, estrangement as it is used in the context of this definition is the act of displacing the observer into the unreal, and Adam Roberts' (2002) discussion suggests that estrangement might, by necessity, arise out of the act of storytelling, but storytelling does not necessarily arise out of the act of estrangement. In fact, the concept of estrangement can be applied to a variety of forms of artistic expression that displace the viewer out of the real or the now but do not involve storytelling. It can also apply to a variety of non-fictional texts. Geoffrey Landis's academic article on the possibilities for colonizing Venus (Landis 2003), as well as countless other similar academic works such as research focused on the Search for Extra-Terrestrial Intelligence (SETI) (Ekers et al. 2002), as well as the extensive body of works commonly referred to as Futurist (Hiltunen 2008), is an act of

cognitive estrangement with no intention of entertaining through storytelling. From speculative documentary screen productions, such as *Life after People* (DeVries 2008), to artistic depictions of unseen exo-planets (Carroll 2017), to the cover art for novels, the act of cognitive estrangement is also common in texts that are associated with science fiction, but are not themselves considered to be science fiction.

Leaving storytelling implicit in the definition of science fiction also deprioritizes that aspect in relation to the novum, estrangement, or whatever you would like to call displacement onto a plausible unreality. This is problematic. As was made overwhelmingly clear in these interviews, these authors conceptualize everything about science fiction, all of the way down to their conceptualization of who they are, in terms of storytelling. Thus, any definition of science fiction, at the very least, must explicitly recognize an equivalence, or a necessary coexistence of storytelling and the novum, or estrangement, and that is the bare minimum. Given the spontaneous nature of the countless comments that directly or indirectly elevate storytelling as essential, it seems reasonable to argue that there should be a logical hierarchy that privileges storytelling over the novum, or estrangement.

If this was the only point to be taken from these interviews it would be an interesting point to debate whether or not, or how, making storytelling an explicit part of a definition of science fiction and/or placing emphasis on storytelling as part of defining the genre make a difference. However, the question of whether estrangement or storytelling is the primary conceptual location of the fiction in science fiction, or whether that even matters, is made even more fascinating when the discussion of definition is extended to how these writers conceptualize the science in science fiction.

THE INDEFINABILITY OF THE SCIENCE OF SCIENCE FICTION

In the definition derived from these interviews, there are three critical terms that describe the use of science in science fiction. It must be plausible, it must be forthright, and it must be a critical element of the story. Each of these terms has multiple implications, some of which do not appear to be part of common academic definitions of the genre. Further, the terms identify conceptual locations where ambiguity and the indistinct boundaries created by that ambiguity are accepted as inherent to the genre. What is plausible shifts over time, forthright is a matter of judgment, and what exactly makes science critical to the story is clearly open to debate. In follow-up discussions with some of these authors, the one frequent worry about this proposed definition was best expressed by Nancy Kress.¹ She was concerned that saying plausible

science had to be critical to the story could be twisted around into something that could be used as a justification for excluding treasured texts, where the science was symbolic, the scene setter, defined the stage on which the story was told, or was in some other way stretching the bounds of how one or more of these three terms might be defined. The flexibility of these terms, which is another way of referring to the ambiguity inherent in the subjective nature of these terms, was of utmost importance to her.

Keeping the value seen in the inherent ambiguity of those terms in mind is then critical when focusing on the terms themselves and what they might mean or imply in the effort to understand what science fiction is. The first descriptor is plausibility. In some ways this fits with the use of cognition by Suvin, but the interviewed authors invest far more thought in the idea of plausibility than is in evidence in how science (or alternative terms such as “cognitive”) is commonly applied to the genre. That further exposes both the fluidity and subjectivity of plausibility.

Greg Bear’s extensive discussion of how he explored possibilities related to genetics and how he discussed scientific dogma demonstrate that any discussion of what is scientifically plausible is embedded within the power structures, hierarchies, and dogmatic beliefs ingrained in the scientific community. “And listening to other scientists talk I realized that there was kind of a patriarchal priesthood of older scientists. I forget what the exact quote was, but one scientist says, ‘You know, the last scientist who holds that position has to die, before it stops being dogma.’ ” In discussing the way power and politics intrude upon the scientific enterprise, Bear is showing that what is considered plausible is contested on grounds that include things beyond evidence and theory.

Bear’s discussion of generational change in what is considered plausible fits with the point Charles Stross made that scientific plausibility is historically constrained and will always reflect the transitory state of scientific knowledge in a given moment. “This is one of the reasons that faster than light travel is a bit difficult to write these days, as is time travel. We can certainly do plausible futurist science fiction about nanotechnology, artificial intelligence and so on, but I’m beginning to relegate FTL or time travel to the realm of fantasy.” Stross is indicating that as science refines our understanding of the universe, what was imagined as scientifically plausible a century ago, or even a few decades ago, is increasing shifting toward the implausible.

A third aspect of plausibility that will prevent a precise line from ever being to drawn to define the edge of science fiction is the term “plausible” itself. Kevin J. Anderson’s discussion of how so many of the aspects of the world around us would have been unimaginable fifty years ago, and how he related that to the FTL question, is a clear example that these authors aren’t in any way sure what the bounds of plausibility might be. This uncertainty

over what could be is also reflected in all the comments about science fiction and predicting the future, particularly in the comments about how poor the track record has been.

Anderson's discussion of FTL is also relevant to the use of the term "forthright" in this definition. As was already discussed at some length, whether it is referred to as handwaving or a McGuffin, whether it arises out of a choice to employ a non-plausible plot device, or stretching the boundary of what might be plausible, or even the act of extrapolating out to a possible future, it is accepted practice for the accuracy of the depiction of science to be compromised in order to tell a story. This is an important indication that the prioritization of storytelling has objective consequences for what is produced within the genre, but it is also another point where the bounding condition for the genre is going to be left indistinct. There is no agreement where the line should be drawn between the unintended inaccuracies that inevitably arise out of speculation and the degree to which it is accepted that science fiction can include a small number of inaccuracies that are knowingly included in order to facilitate storytelling.

Forthright is used to reflect that absence of a strict and clearly defined line in this regard, while still indicating that a meaningful engagement with the spirit of the science that is in the story is essential. When Simon Morden discusses his story about a ship moving near the speed of light, he is talking about respecting every little detail about what science tells us about the reality of traveling at relativistic speeds, while waving his hands at some of the currently unimaginable details for the engineering that would be involved in accelerating that ship to that speed in the first place. That handwaving is accepted, and, as Morden indicates in his interview, his fiction is clearly and consciously focused on elevating the ideal of the forthright use of science. Forthright means that when Larry Niven writes about Ringworld, he can wave his hands at things such as FTL and focus his storytelling on the science and engineering that might allow such a marvel to be built.

Forthright also means that when Larry Niven writes a story about an interstellar ramjet, he not only respects how the science of the time imagined that such an engineering marvel might work, some of those details are used as a central element of the story. They might serve as the impetus driving the story as the disruptor of the status quo or the challenge to be overcome, or they serve as means of solving those challenges. This connects to the role of science as a critical element of the story. Steven Barnes discusses Larry Niven's approach as imagining the science and finding a story from it, while Barnes describes his own approach as having a story to tell and finding a plausible scientific mechanism to allow him to tell it. In both ways, the science is critical, and in both approaches being forthright means respecting the spirit of science that is critical to the story, but what science is critical and

how it is critical vary a great deal. This variation extends to the extent that science is part of the story, from stories where the science central to every aspect of the story, to stories where it is simply something that sets the stage or is used as a fulcrum for an examination of the human reaction to change or circumstance. Again, this is a point of accepted ambiguity that makes it impossible to offer anything close to a precise bounding condition for what is or is not science fiction.

DEFINING USING EXCLUSION AND CRITICAL IDEALS RATHER THAN BOUNDARIES

With a variety of different factors where both a great deal of ambiguity is accepted and where a wide range of difference is expected, it may well be fruitless to try to conceptualize a definition of science fiction in terms of boundaries. This is not an uncommon situation, particularly in the social sciences, and a classic work from the social sciences suggests an alternative approach.

A key premise of Lewis Coser's *Functions of Social Conflict* (Coser 1956) is that it is impossible to ever precisely define the boundaries of any social group. Instead, social groups define their membership in terms of exclusion and in terms of performative expressions of a commitment to critical ideals. For Coser, the ways these aspects of pursuing self-definition out of ambiguity drive conflict are the points of interest, but for the academic study of science fiction, the acts of exclusion and performance of ideals provide an interesting perspective.

In social groups, the acts of exclusion are embodied in the dehumanization of others and engaging in conflict with them. In defining science fiction, the act of exclusion is most evident in Robert J. Sawyer's simple statement that "Star Wars is not Science Fiction" and his discussion of why, but it is also evident in Charles Stross's comment that FTL and time travel are increasingly difficult to write as science fiction. Stross's comment expresses the acceptance of all the ambiguities inherent in the science of science fiction and how they translate into a definition without distinct boundaries. Difficult indicates that he believes they have entered that indistinct zone where establishing plausibility is a challenge that may soon become impossible, and increasingly indicates that this has changed and will continue to change over time. However, his comment also implies that it is the plausibility at the time of writing that matters. Thus, it is highly likely that he considers H. G. Wells's *Time Machine* (Wells 1895) to be science fiction, and that it will continue to be science fiction no matter what happens with the science related to time. By using the term "increasingly difficult" Stross is also indicating that

he believes that at sometime in the future, many story tropes will exit the grey area at the edge of the genre and will be considered by all or most writers as something where the science can no longer be considered plausible.

The other aspect of groups forced to work with an inability to precisely define the boundaries of their group is the veneration of the effective or salient expression of core ideals, and this is probably more relevant to the question of generating a more useful academic definition of science fiction. In sociopolitical groups, this can have either positive or negative effects, depending on the nature of the ideals offered as the core values. For example: if democratic values are offered as a defining ideal, the expression of this veneration of the expression of a defining ideal can be a positive means of conflict resolution, while other ideals can lead to racism or fascism. For the study of science fiction, the interviews suggest that storytelling and science as an essential element of the story are the two key ideals that are venerated. As such, they can be offered as a way to define what is the heart and soul of an indistinctly bounded genre. For the study of literature in particular, rethinking science fiction in terms of two ideals might be where this definition can offer a significant contribution to those studying the genre. Expanding the discussion here to move just a bit beyond the bounds of what is in these interviews, some qualitative assessments of the qualities inherent in works from some of the most notable grandmasters of the genre offer an indication of how we can work with a definition that does not focus on strictly defined boundary conditions.

First, since one of those ideals is storytelling, this represents an opportunity for identifying aspects of congruence with definitions such as Suvin's. Suvin is working from the perspective of literature and a great deal of the science fiction that is thought of as literary science fiction is revered within the genre even though it tends to have only limited engagement with the underlying details of the science that serves as a critical element. Instead this type of science fiction focuses heavily on the storytelling ideal, particularly when it engages the human impact of the science or technology or even just the environment created by advances in technology. Such works are considered to be essential to science fiction by just about everyone in the genre, and are often highly regarded by everyone within the genre, but it is important to note that those stories represent only a portion of the genre.

Authors such as Ursula K. LeGuin and Arthur C. Clarke are revered because storytelling is a fundamental, defining element of science fiction, and as a result, it serves as an ideal that is elevated in the works often offered as iconic. Both LeGuin and Clarke wrote what have become iconic novels that have tremendous stories spun out of a limited engagement with the critical element of science that enables those stories to be told. In elevating the storytelling ideal, both academia and those working within the genre are idolizing

some of the same works. However, what academia tends to miss or diminish, and what the definition offered in this chapter reflects, is that the forthright engagement with plausible science is also an ideal, and those within the genre hold it in equal or near-equal regard to the storytelling elements that are revered in the study of literature.

THE SCIENTIFIC NOVUM AS AN IDEAL AND AN ART

When a forthright depiction of plausible science as a critical story element is considered as a co-equal or nearly equivalent ideal to literary ideals of storytelling, it suggests that definitions such as Suvin's are failing to truly capture one of the more significant features of the landscape of science fiction. Despite the extensive focus on the novum in the debate over the definition of science fiction, the academic perspectives on the genre appear to undervalue or simply dismiss the extent to which those involved in the genre revere the creative employment of plausible science in storytelling. It is reasonably fair to say that few of the authors working in the genre, and few of the highly engaged fans of the genre, would argue that Larry Niven is a fantastic storyteller. In fact, as part of some casual discussions at the 2018 World Con in San Jose about what made a book a "great" science fiction novel, I ran this rather common opinion past several authors, including co-authors of Niven's. The claim always got a nod of agreement, even when the author went on to say that Niven is a better storyteller than most people give him credit for. Further, that comment on Niven's storytelling also invariably led to the authors I was talking to offering effusive praise for how Niven repeatedly managed to produce "mind-blowing" leaps of imagination in what he created out of the science he was working with. To use Suvin's term, that unmatched ability to create the novum is, in and of itself, reason for Larry Niven to be a Grand Master of the genre, which is not a superlative. It is a lifetime achievement award bestowed by the Science Fiction Writers of America.

However, if the use of science in the telling of a story is considered as an ideal that is so essential that it must be part of the very definition of science fiction, then it also explains how those within the genre can agree that both Ursula K. LeGuin and Larry Niven are grandmasters and how both *The Left Hand of Darkness* (Le Guin 1969) and *Ringworld* (Niven 1970) are considered masterpieces. The engagement with the relevant science might be limited in the *Left Hand of Darkness*, but the human elements of the story and the storytelling are compelling and on that basis of that ideal, both those involved in the genre and academic scholars recognize it as a significant work. In contrast, however, the fact that Niven's storytelling is nowhere close to equal to LeGuin's all but eliminates any real appreciation for *Ringworld*

from the perspective of literature. While Niven's ability to engage that second ideal, the forthright depiction of plausible science is considered by those within the genre to be a representation of that second critical ideal of science fiction. Niven turns the act of estrangement or the creation of the scientific novum into an art form of its own and for those working within the genre and the fans that are so passionately engaged with science fiction, simply exploring the worlds Niven creates is an experience that is revered in equal measure to the storytelling of LeGuin.

This is not to say that science fiction is a choice between these two ideals. William Gibson and Neal Stephenson are two examples of authors that are commonly well regarded in respect to their ability to simultaneously engage both ideals. What this does say is that for academics, particularly literature scholars, to idolize the storytelling ideal and denigrate the artistry of employing science as a critical element of storytelling reflect a fundamental misunderstanding of the genre and represent an ongoing point of friction. This is one place where these interviews, and carefully considering the perspectives of these authors, can offer something significant for the academic study of the genre and its texts.

CONCLUSIONS (OR THE LACK THEREOF)

Concluding a study with a call for further research may be cliché, but it is clearly where this exploration ends. The most important conclusion to be drawn from this effort to privilege the voices of these authors is that a careful and nuanced construction of a science fiction ecosystem, or something similar, has the potential to offer significant contributions to how these texts are employed in research, and how their meaning is interpreted. Not only does that ecosystem represent the mediated space that science fiction occupies between science and society, it is also probably the best possible description of the context from which these authors are producing the science fiction texts that academics study. Understanding that context, particularly in terms of the imperatives and ideals it creates, is critical to understanding science fiction and all of the sociopolitical communication roles it might play. It was only possible to sketch the simplest of outlines of this ecosystem from these interviews, but even in that there are clear suggestions of value. Those suggestions of value clearly indicate that a focused effort to produce a more detailed depiction of the ecosystem is likely to be worth the effort.

That need for more study acknowledged, there is a great deal of value that can be extracted directly from simply listening to the comments that these authors choose to offer in a minimally structured interview. The simple fact that they frame so much of their commentary in terms of entertaining through

storytelling is striking, and it suggests that everything else is secondary to that. Simply recognizing that can have some immediate impact on several areas of study, particularly in terms of constructions and representations in science fiction texts. The scientist is first and foremost a character, and must be treated as such before considering how the construction of that character represents the reality of science as a profession, or scientists as people. Similarly, any discussion of the way science fiction might serve a science education role, inspire scientists, or encourage people to become scientists needs to acknowledge that storytelling comes first and any of those things are a result of engaging readers through an entertaining story; they are not the purpose of the texts.

Another immediate contribution from simply considering these interviews and prioritizing what these authors are saying or trying to say is that despite a great deal of variety in the way that they discuss engaging science as part of science fiction, science is clearly seen as essential. Whether “forthright” and “plausible” are the best terms to capture the way they consider science to be not only a central element of science fiction but also a critical element that defines the genre is debatable. Regardless, there is a great deal to be gleaned from those comments. The way these authors discuss science and storytelling appears to fall into two categories. Several of the authors refer to the human impact of science and speak of it in idealistic terms, some even saying that it is what science fiction is all about. Other authors talk in similarly idealistic or definitional terms about various ways that science itself is essential to or enables storytelling.

Discussing those as two, coexisting ideals within the genre is one way to address that variety, and it provides some suggestions for one of the reasons that there is still friction between the genre and academia, particularly in terms of the academic study of literature. Academia has grown to embrace the science fiction that represents explorations of the human impact of science as an ideal, perhaps to the point of stealing from the genre by relabelling it as literature, as Robert J. Sawyer claimed. However, that second ideal of building the story out of the science itself has, at best, gone unrecognized. The result is a skewed academic perspective on the genre that ignores or dismisses a whole category of essential texts, often while praising marginal or obscure works. This creates the impression that the academics who study and criticize science fiction do not read it and do not understand it. Perhaps, because the ideal of making the science itself the story is ignored or unrecognized, that complaint is offering a valid point. Maybe academics do not understand science fiction and should read more of it, with a particular emphasis on texts that embody the second ideal. Would the academic perspective change if Larry Niven and Ursula K. LeGuin were held in equal regard, as they are by those within the genre? Probably.

That alone suggests a great deal of academic work needs rethinking or a reexamination. That alone suggests that going forward, some additional thought is needed on the selection of texts for study. Yes, a great deal more is needed here, but there is already something to work with and, hopefully, by providing the interviews here for others to use, further steps can be taken.

NOTE

1. Email correspondence concluding on 23/04/2019.

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