

Culture, Science Fiction, and Complex Adaptive Systems: The Work of the Genre Evolution Project

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1. INTRODUCTION

The environments in which they lived dramatically affected the evolution of early humans, who in turn changed these environments as they adapted to them. Eventually, they developed culture and even sagas about their environment, the gods that ruled it and the heroes that conquered in it. And in turn these stories of the past affected future lives by passing on conceptions about the environment, the gods and the heroes that interacted with them.

The creations of culture often arise in response to well established facts of life. *The Iliad* arose centuries after the Trojan War. But culture can also track or lead life. As a tracking example, consider that during World War II, both Hollywood and Berlin maintained offices of information to shape their nation's popular culture. Harriet Beecher Stowe's *Uncle Tom's Cabin* is a good example of culture leading life. It exposed tens of thousands of Northerners to the horrors of slavery and played a role in the North's resolve to fight the American Civil War. Fifty years later, Upton Sinclair's story of Chicago's meat-packing industry, *The Jungle*, precipitated the passage of America's first Pure Food and Drug Act, although Sinclair himself was more focused on labor issues in the industry.

The relationship between culture and its component products is a complex one with each affecting the other, with feedback loops, with emergence and parallel evolution. The Genre Evolution Project at The University of Michigan has been studying American science fiction short stories in order to explore the benefits that may derive from treating culture and cultural production and consumption as a complex adaptive system.

2. COMPLEX ADAPTIVE SYSTEM APPROACH

Before describing the U-M Genre Evolution Project, we present an overview of the complex adaptive systems approach. This approach begins with the view that the object under study is one of many components in a larger system, and is itself a system too. A key part of this systems approach is that a change in any component of a system can have direct and indirect effects on other components of that system. Failure to appreciate these interconnections can lead to misunderstandings or even disasters.

For example, an insect that eats agricultural plants is part of a larger ecological system of predators and prey – an intricate food web. The introduction of a new plant or animal into this system can have dramatic effects on the system as a whole and on individual elements of this system. A pesticide that inhibits the insect may have positive effects on the crops the insect eats and negative effects on the creatures that eat it. Some insects can develop immunity to certain insecticides. Plants can evolve defenses against some insects, which in turn can evolve mechanisms to get around these defenses.

The body of the insect is itself a complex system, as is each component cell of that body. An effective pesticide would target one of these subsystems. In fact, a biologist could study the insect at many different scales: from the genomic to the cellular to the organismal to the ecological, and would be interested in how these different scales interact with each other.

In short, a complex systems approach:

- treats the object of study as a component or subsystem of a larger system,
- recognizes that these components and their connections are dynamic,
- takes into account the many scales involved and tries to understand how behavior of the components at one scale relates to the behavior that emerges at higher scales,
- takes into account the evolutionary history that has conditioned the components' structures, functions, and constraints,
- tries to ascertain important measures and criteria of fitness and the processes of selection on those criteria,
- understands that, in this evolutionary point of view, the components in the system receive feedback on their actions and may modify their future actions accordingly.

3. CULTURAL CREATIONS EVOLVE AS COMPLEX ADAPTIVE SYSTEMS

There are many reasons why it is natural to use a complex systems approach to study cultural changes. We list some of the more obvious ones.

3.a Multiple Scales

As we have just pointed out, a complex system usually has many levels or scales. In taking a complex systems approach, one usually works with multiple levels and shows what properties emerge at one level from assumptions and analyses at lower levels. For example, in biocomplexity analyses of disease-spread, properties of viruses at the genomic level enable the viruses to invade and destroy cells at the body's cellular level, which in turn may affect the body's immune system at the physiological level, leading to infection at the individual level and to epidemics at the population level.

Culture itself is a multi-level phenomenon. The system called "culture" includes literature, art, music and architecture. One level lower, literature, for example, can be broken down into different genres, such as war stories, romances, detective stories, science fiction. Within each genre are the archetypal stories in that genre.

Similarly, a work of literature begins with words and phrases, which may or may not be poetic, and which in turn form sentences, which may, for example, be propositional, metaphorical or ironic. Combinations of these sentences lead to descriptions of characters and their activities. These are dual developments, as Henry James points out in "The Art of Fiction" (1884): "What is character but the determination of incident? What is incident but the illustration of character?" These activities and "incidents" lead to character development and to plot formation, thence to the outcome and overall impact of the story.

3.b Connections among cultural components

As in every complex adaptive system, the components of a culture are connected in important ways to each other, and one cannot fully understand a component of culture without understanding those connections. For example, the title of Faulkner's *The Sound and the Fury* is an ironic allusion to the line "It is a tale told by an idiot, full of sound and fury, signifying nothing" in Shakespeare's *Macbeth*. This allusion leads to the recognition that it is the idiot Benjy Compson who has the central story here. Benjy doesn't die, but he is castrated to placate society when he is 33 years old, an allusion to the life of Jesus. One who misses both allusions is unlikely to understand the moral weight that Faulkner gives Benjy or to understand why Benjy's narration is the first part of the book.

3.c Culture seen relative to the Outside Environment

As in every complex system, cultural works have to be seen in the context of the environment in which they were produced and consumed. A cultural product such as a work of art is not merely a thing-in-itself but a thing-as-used. Clothing fashion demonstrates this. A garment from our grandparents' generation will do as well as one of today's to protect us from sun and rain, but we find "old fashioned" garments undesirable or quaint or marks of economic constraint, the last quality reflecting the old-fashioned garments' lower price in the marketplace we all share. Yet paintings by "Old Masters" do not depreciate. Markets move up as well as down and every cultural product has its equivalent of fashion, even if, as with religious ceremony, the rate of change may be slow.

The cases of Daniel Defoe and Jules Verne demonstrate dramatically the need to understand cultural products as things-as-used. The anonymously published "The Shortest Way with the Dissenters" (1702) called for vicious suppression of those who, though Protestant, dissented from the Church of England. Many Anglican clergymen and politicians acknowledged publicly that these means, though terrible, were necessary. Then the author was revealed to be Defoe, a well known Dissenter. The Anglicans, who suddenly seemed like fools for not recognizing the pamphlet as satire, had Defoe pilloried and imprisoned. When is a work a satire? Only when it is understood as such.

In 1864, the Confederate submarine *Hunley* sank the Northern frigate *Houstonic* in the harbor of Charleston, South Carolina. Although the crew of the *Hunley* died in the effort, they managed the world's first militarily successful use of a submarine. This was well and widely known when Jules Verne's *Twenty Thousand Leagues Under the Sea* appeared in 1870. Yet as the memory of the *Hunley* faded, it became more common to point to Verne's novel as "inventing" or "predicting" the submarine. In that context, the viewpoint character's lengthy argument at the novel's beginning that there could be no such vessel seems to set up the reader to applaud Verne's prescience. In fact, it set up Verne's contemporaries to recognize satire aimed at the viewpoint character. Missing the satire, many modern readers found Verne windy, and his literary market value fell accordingly.

3.d Cultural creations interact with their environment

A truly *complex* adaptive system not only responds to its underlying environment, but its actions can also change that environment. Such complexity is definitely a characteristic of cultural creations. Cultural creations commonly reflect the environments in which they are created – usually past environments but often current ones. Post-World War II novels, such as *Catch-22*, *The Naked and the Dead*, and *Fires in the Plain*, captured the horrors and ironies of that war and of war in gen-

eral, while the screenplay for the jingoistic *God Is My Co-pilot* was written (by William Faulkner and others) in 1944 in the midst of the conflict. Simply said, because it was wartime, they wrote about war.

On rare occasion, the order of influence can be reversed, as when a specific book is credited with affecting the wider culture. As we noted in the introduction, *Uncle Tom's Cabin* had an immediate and electric effect on the hearts of tens of thousands of people who had never before considered slavery except as a political institution for which they had no personal responsibility (Warner). The novel played a role in the North's resolve to fight the Civil War.

In Charlotte Perkins Gilman's "The Yellow Wall-paper" (1892), the young-woman protagonist is brought to a country-home by her physician-husband for a rest cure. This story portrayed the chains that bound women to home, family, and the parameters that men dictated in the late 1800s. By exposing the power that men wielded over women, it helped women escape their confinement and presaged the suffragette and feminist movements of the twentieth century.

But even in those rare instances when a book does seem to move the larger culture, its complex influence may be unexpected. As Sinclair himself said of *The Jungle* (1906), "I aimed at the public's heart and by accident I hit it in the stomach" (Quoted in Downs, 349).

In addition, whole classes of works may have an influence on the larger culture. Typically, that notion is treated ironically or worse. For example, as a result of reading too many romances, Cervantes' *Don Quixote* became the addled and anachronistic Knight of La Mancha. Two centuries later, the suggestion was that Victorian women wasted their lives reading novels. Now there is a parallel concern that today's children acquire unhealthy attitudes toward gender relations by reading comic books.

3.e Other Mechanisms of Genre Change

The view that culture and cultural creations evolve as complex adaptive systems that succeed or fail according to their fitness to their environment, just as biological organisms do, is both obvious and desired but rarely noted and then usually dismissed.

Literary criticism has traditionally assumed three mechanisms for how changes occur in a cultural genre: individual genius, changed historical circumstances, and the inner logic of the genres themselves. Individual genius certainly is one factor. No one had ever used a time machine in fiction before H. G. Wells, while afterwards it became a staple. However, the mere invention of the time machine did not make it a staple. Wells used it in *The Chronic Argonauts*, published in 1888, and no one picked it up at all. Only after that novel was substantially rewritten and published as *The Time Machine* in 1895 did the device achieve "instant"

fame. In other words, while individuals invent and show the way, they can do so effectively only in a context in which others can be induced to follow.

Changed historical circumstances are significant factors in genre change. In the opening decades of the Age of Television, Westerns were popular in American living rooms. Then, in the post-Sputnik era, the West seemed a quaint frontier and Westerns disappeared. Recently, however, the series *Deadwood*, with its brutality and vulgarity, has found an avid audience by using the West as a metaphor for the sometimes ugly ways capitalist democracy is born. But *Deadwood*, because of its sexuality, violence, and gutter language, cannot be shown on American broadcast television. The Western has returned in a different form and place and only for an audience that can afford subscription television.

As an example of the role of the inner logic of a genre as a mechanism for cultural change, consider the Tale of the Great Detective, works like those by Edgar Allan Poe, Arthur Conan Doyle, and Agatha Christie. In "The Case of the Purloined Letter," Poe's Dupin states the solution to the mystery and then spends the second half of the story explaining how he achieved that solution. With Doyle, that crux, when the tale turns from suspense to explanation, is moved further toward the end. And with Christie, it is moved further yet. It seems that the inner logic of the genre requires that the discharge of suspense be quicker and quicker after a comparatively longer and longer buildup. Most modern detective stories save the identification of the perpetrator for the last chapter, with many false leads along the way. Yet this "inner logic" reflects the jading of the readers' palate, that is, a change in taste. For those who still want Poe or Doyle or Christie, their works are very much still in print. Modern writers rarely emulate them – they seem old fashioned – but the Old Masters do not lose market value.

Regardless of the mechanism assumed, the traditional approach is to study a few outstanding examples of the genre. The effect is a focus on masterpieces as the "best" works, and therefore most worth our detailed analysis. A systems approach would claim that masterpieces are, by definition, not representative. Since we recognize that complete genres (e.g., utopian fiction) have fluctuations in their market values, focusing on non-representative texts does not provide the necessary information to explore the evolving relationship between the genre and culture as a whole.

4. THE BIRTH OF THE GENRE EVOLUTION PROJECT

The Genre Evolution Project was born at a workshop whose goal was to spark such interdisciplinary interaction. The University of Michigan Center for the Study of Complex Systems (CSCS) regularly organizes a workshop on complex systems, in conjunction with The Santa Fe Institute (SFI), the first institute in the world to focus entirely on the study of complex adaptive systems. (Waldrop's *Complex-*

ity gives a history of the development of the complex systems approach with a focus on the founding of SFI.) During the Fall 1996 workshop, U-M English Professor Eric Rabkin approached U-M Mathematics Professor and CSCS Director Carl Simon with the idea of using complex systems techniques to study the evolution of culture as a complex system. Both Rabkin and Simon had histories of interdisciplinary research. Rabkin regularly teaches courses, writes research papers, and edits anthologies about science fiction. He has also assisted in running U-M's Information Technology Division and has had an active interest in connections between the humanities and the sciences. Simon has written and taught extensively on dynamic mathematical models in economics, political science, and epidemiology. He has joint appointments at U-M in Mathematics, Public Policy and Economics. After months of discussions and plans, Rabkin and Simon began the project in the Winter term of 1998 as a collaborative effort with a team of U-M undergraduates making extensive use of new technologies to facilitate the project's teamwork and analysis.

Our first step was to choose a literary genre on which to focus their complexity approach to culture. We quickly chose the American science fiction magazine short story as the object of study. First of all, Rabkin has had extensive and successful experiences writing about, compiling, and teaching about science fiction (SF). By focusing on short stories (<12,000 words) that were published in American science fiction magazines, we had a genre that was well-defined operationally. Furthermore, this genre has a recent, easily researched history since the first such magazine (*Amazing*) appeared in April of 1926. In addition, there is a uniquely powerful set of bibliographic tools on the web, including ISFDB, which tries to list all original SF stories and their reprints, and Contento's Index and its continuation, the Locus Index, which are databases of SF anthologies and collections. In addition, many SF magazines had active letters columns and demographically clear advertisements, and thus provided good opportunity for tracking both contextual (environmental) and textual (organismic) information in a complex systems approach to the genre. Taken together, these factors permit numerous approaches to studying adaptation with SF short stories. For example, the creation and demise of the numerous SF periodicals allows examination of the mutation and extinction of the editorial policies that determined publication of individual stories.

Rabkin and Simon envisioned a complex systems-oriented study of the evolution of this genre that focused on basic components of the story, of the author, and of the SF magazine. Members of the team would read a story and then code it, that is, represent it in what may be considered as a point in a high-dimensional space of story characteristics or as a "DNA-string" where each position on the string corresponded to a story characteristic. This quantification would enable team members to see how these characteristics relate to each other and how their relative

frequencies changed over time and at multiple scales. Reader/coders would not directly comment on the literary value of a story, but would work with more objective and quantifiable characteristics of the stories. They would seek measures of success or "fitness," such as number of reprints. They would use statistical techniques to characterize what properties or clusters of properties (for example, which associations of genre form with genre content) correlated with high fitness at various levels. Furthermore, team members would use the changes in the DNA-strings over time to see how the genre components were shaped by the events and environment around them – past and present – and how they had an effect on future events and environments.

5. THE EVOLUTION OF CODES FOR CHARACTERISTICS

The first meetings of the GEP began in January of 1998. From the start, we viewed the GEP as a totally collaborative project in which students would play major, often leading, roles in all aspects of the project, including its establishment. The group's weekly ninety-minute meetings would be discussions – sometimes led by Rabkin or Simon, sometimes by a student member. The first students were recruited from Rabkin's science fiction class. Our immediate challenge was to define a set of characteristics of what distinguished a given story from other stories. These characteristics needed to be carefully and objectively defined so that they would allow useful coding. They should be amenable to statistical analysis and important enough that this analysis sheds light on the evolution of the genre. Guided by Rabkin's experience and expertise in literary analysis, Simon's understanding of systems and of experimental design, and probing questions generated by both, team members came up with over twenty fields that represented the stories read.

5.a Genre Theme, Form, and Content

Among the first categories we chose to code were theme and genre. Theme is basically what the story is about: love, heroism, coming of age, and so on. Although it took the coding of many stories to settle on an exhaustive list of mutually exclusive values for this characteristic (this "field" in the language of database design), the field itself has remained part of the GEP ever since.

Another initial field was "genre," meaning subgenre within the genre of SF. Was the story an alien contact story, a time travel story, and so on? The group struggled with genres mightily, unable to settle on a list that provided an exhaustive and mutually exclusive set of values for coding this field. The same story, say H.G. Wells's *The Time Machine* (1895), could be both a time travel story and an exploration. In using the term "genre" this way, the GEP followed the standards of criticism of popular culture, which also refers, say within detective fiction,

to the "locked-room mystery" genre. Yet we could not construct a satisfactory value list. Finally we came to realize that the candidate values for our SF genre field were of two fundamentally different types. Some, like "alien," "invention," "mad scientist," or "time travel" referred to crucial elements of the content that made the work plausibly SF; others, like "alien contact," "exploration," "puzzle," and "parody" suggested characteristic narrative forms. As soon as we made the distinction between "genre content" and "genre form," not only could we feel we had adequately reflected *The Time Machine* by our coding but we were able to come up with a working value list for each of those fields. Thus is it possible to have an alien (genre content)-alien contact (genre form) story but also possible to have an alien-exploration or time travel-alien contact story. The distinction between "genre form" and "genre content" seems to us a methodological discovery extendable to all categories of art work. For our purposes in studying SF, we settled on 17 values for the genre content field and 15 for the genre form field.

5.b Outcome

A fourth major characteristic chosen was "outcome". Since we settled on only eight possible outcomes, we will use this field to describe in more detail distinctions among values. (For a complete list of fields, values, their definitions, and decision trees, go to the GEP website: <http://www.umich.edu/~genreevo>.) The outcome is defined as the effect the story had on its implied reader at its ending. The implied reader is the reader the text implies we must construct ourselves to be in reading the work. For example, an adult reading a Nancy Drew or Hardy Boys story, must in some sense take on the assumptions of a youngster or the story will fail. A coder's first step in discovering the story's outcome is to decide who the implied reader is. Then, reading from that viewpoint, if a story leaves the reader with no way to decide among one or more possible understandings of the work, its outcome is "ambiguous". If it teaches a lesson, like an Aesop fable, its outcome is "didactic". If the outcome was never really in doubt in that the ending of the story fulfilled the ideals set out at the beginning, its outcome is "romantic".

The remaining outcomes are: tragic, comic, tragicomic, happy and sad. Comic, tragic, and tragicomic are terms for outcomes in which our main interest has been in characters who represent their societies, stand for them, and in some sense have fates that indicate how their societies will progress; tragic when there is a breakdown of social order (e.g., *Oedipus*), comic when there is a good re-establishment of social order (*Pride and Prejudice*), tragic-comic when the re-establishment is accompanied by a catastrophe (*Tale of Two Cities*). Sad and happy are terms for corresponding outcomes in which our main interest has been in characters who merely inhabit rather than represent their societies. The

outcome of *Bonnie and Clyde* is sad but is not tragic, comic, or tragicomic. We feel sad when the title characters are killed, but we recognize that society will go on unaffected. In *The Time Machine*, the last section shows the Victorian narrator waiting helplessly for the return, which will never happen, of the Time Traveler. The implied reader has no way of knowing if the Time Traveler was able to save the child-like Eloi. However, we do know that that rescue would be unnecessary if one could abort the degeneration that led to the bifurcation of humanity into effete Eloi and cannibalistic Morlocks, a possibility if one resisted the current segregation of the working and owning classes. The ending, then, is a lesson for the implied reader: work toward mutual communication and respect among the social classes or expect degeneration and violence. The outcome is didactic.

5.c Character Dimension

As we mentioned in Section 3A, characters and their development are key components in the analysis of literature as a complex system. Thus, it is natural that the GEP takes character properties as key characteristics in our coding. Two aspects of character play important roles. The first focuses on objective descriptions of the main characters in a story: their number, sex, age, and, for science fiction stories, their nature (human, robot, and so on). The second focuses on how well developed characters may be. GEP coders keep track of the number of three-, two-, and one-dimensional characters in a story. Three-dimensional characters are presented in enough detail that the reader feels that he or she could predict the character's behaviors in some hypothetical situation not involving the narrative world in which the character was first encountered. A two-dimensional character can be thought of as comparatively stereotypical, for example, the villain who is unalloyedly malicious or the kind-hearted ditz who is always amiably befuddled.

One-dimensional characters, a field we invented for the GEP study of SF but which applies in every type of narrative, function like *active* parts of the setting, such as a voice in the crowd, or the crowd itself. We count them as characters only when something in the story (such as their action) distinguishes them from being mere background. After working with this concept, the GEP members agreed that the true count of 1D (1-dimensional) characters should not be their absolute number (we are not concerned with the exact population of a celebrating crowd) but rather the number of *instances* of 1-D characters. An instance is a scene in which 1D characters function. Each such scene counts as a single instance regardless of the number of 1D characters involved in that scene.

Eventually, the GEP team settled on 34 fields, including dominant science (if any), plot form, plot duration, story duration, sentence style, and setting time.

6. CURRENT METHODOLOGY AND INTERACTIVE DATABASES

The core work of the GEP is the reading and coding of short stories in American SF magazines. Each year two student managers are chosen as coordinators of the day-to-day responsibilities. These managers divide the GEP student team into pairs and each week assign a number of stories to each pair – typically the stories in a single issue of a SF magazine that is available either on line or in the U-M library (which owns a considerable collection of SF magazines, especially in microfilm form). The students read and code their stories without consulting their partner and by the end of the week meet with their partner to compare their coding decisions and work out any differences.

The challenge now was to find how to record their coding decisions in a way that was easy, permanent, available to the whole team, and amenable to analysis. Thanks to Rabkin's experience with information technology, the team began using an interactive web-based database; entering their codings was as easy as answering a multiple-choice questionnaire.

However, treating the characteristics of each story in isolation goes against the very essence of the complex systems approach. How do the stories relate to other stories in the genre and to the environment of the genre as a whole? To fill this gap, the GEP team created two other databases: the author database, which contains among other things the name, year of birth, sex, and home of the author(s); and the context database, which contains information about the magazine in which the story appeared, including date, editor, and target audience (often inferred from the advertisements). Each of these three databases – text, author, context – were initially stand-alone databases. Because they are naturally linked to each other through the stories, the GEP then constructed an all-encompassing relational database (using Microsoft Access), with each of these three as a table within that more capable database. The use of a relational database meant that the GEP members could query all fields at once. For example, one could study stories written in the 1960s by women, with alien protagonists and sad endings.

In addition to the paired readings, the team managers assign one story each week for a group analysis. Team members read and code this story individually and bring their codings to the Wednesday GEP meeting. Team members take turns each week leading a discussion of the group-read story. These discussions are important in hammering out individuals' understanding of the coding process and of how to choose among the values in a text field when the choice is difficult. Sometimes, definitions of the values have been clarified or lengthened. To help guide the coding process, during the 2004-2005 academic year the team began constructing formal decision trees for the most difficult fields.

7. SOME RESULTS

Of course, the whole reason for using a complex systems approach is to understand better the genre and its evolution. Other approaches had led to truisms about the genre, that had become accepted without the careful analysis one should expect from genre experts. The GEP now had a large number of data, about 2500 SF short stories in a relational database designed for statistical analysis.

7.a The Impact of John W. Campbell, Jr.

One such truism is that John W. Campbell, Jr. was the dominant force in shaping the aesthetics of SF. When he took over *Astounding* in 1937, Campbell announced his intent to increase the depth of SF's characters, in response to the criticism that SF stories focused on ideas and technology at the expense of well developed characters. After examining in detail the prevalence of 3D characters in SF stories in general and specifically in *Astounding* during Campbell's editorship, we found that the fraction of 3D characters actually decreased during the Campbell era – the so-called "Golden Age" of SF. In fact, character sophistication did not rise until the late 1950s, when paperbacks replaced magazines as the major outlet for SF short stories and SF novels began to dominate. (Rabkin, Mitchell, Simon)

7.b Women Authors

Another truism centers on the timing and place of women as SF authors. For example, in 2002 Susan Urbanek Linville did a statistical analysis of the publications of women authors in what she called the Big Four science fiction magazines. She rightly concluded that women had become more prominent. She attributed this increase to three factors outside the realm of science fiction: "feminism,"... "the Fantasy explosion in recent decades and a greater number of women becoming interested in and choosing careers in science". To Linville the order of influence was clear; the works of art served as reflection only of the forces in the larger culture. She did not question her assumptions about that culture or ask why the "Fantasy explosion" occurred at all or consider the bases for her assertion that "women tend to write more fantasy than science fiction".

Using the text and author data in our relational database, we were able first to seek the differences, if any, between the SF stories women wrote and those that men wrote. (Rabkin & Simon) We found that for nearly every field, including the genre form and the use of "hard science," there were no significant differences. Three exceptions were that women tended to write much shorter stories, their main characters were younger than those in male-written stories, and half of the main characters in stories written by women were women, while only 7% of the

main characters in male-written stories were women. Furthermore, the fraction of stories written by female authors did not show a rapid growth spurt during the feminist movements of the 1960s, but increased linearly and steadily, from 2 percent in the 1930s to 22 percent in the 1990s – a trend line more consistent with leading the woman's movement rather than following it.

7.c Doctors in Science Fiction

Given the fame of Mary Shelley's *Frankenstein*, one would expect that medical issues would play a major role in SF, yet a careful look at our database indicated that medical stories are substantially underrepresented among SF short stories; and there was a below-normal reprint rate among those that did appear. (Rabkin, "Medical Lessons...") However, among the few that were reprinted, one can find some of the most successful and most reprinted stories in the genre. When we examined these for their common features, we found an underlying belief that doctors – who clearly hold our lives in their hands – were rejected as gods, but accepted when they abnegated themselves for the sake of the community. In the reprinted medical SF short stories, the doctors are selfless or else come to a bad end.

7.d Concerns About the Decline of Science Fiction

Another widely accepted view among academic critics of SF is that SF is a declining field, a view largely based on the smaller number of SF stories printed in SF magazines today compared with twenty years ago. Judith Berman analyzed this situation by reading over a year's worth of recent issues of *Isaac Asimov's Science Fiction Magazine*. She concluded that: 1) the average age at publication of the authors of those stories was substantially higher than the average age of the authors writing in The Golden Age, and 2) these stories did not exhibit much hope for the future, much less a hope grounded in technology. She inferred that (2) was caused by (1) and further that the decline in SF comes from a growing uninterest for such pessimistic stories.

Our team read those same stories and analyzed them with all the tools at our disposal. Regarding authors' ages, we analyzed the average ages of authors over the past fifty years and found that they follow the expected timeline of young authors at the inception of a new genre, with average age progressing naturally as these authors aged and continued to write, reaching and settling at the expected plateau level. Furthermore, we used the database to search for stories that took place in the future, had a physical science as their hard science, and had positive outcomes. We found that the prevalence of such stories in the 1985-2000 period was the same as their prevalence in the Golden Age (1940-1955). Furthermore,

even though fewer SF stories were published in SF magazines in the last ten years, SF has had a vast impact on popular culture through SF movies, novels, television programs, and video games, a reality the mourners for SF seem to ignore.

8. CURRENT PROJECTS

In addition to the group coding, much of the weekly Wednesday meetings are spent dealing with projects that complement the main coding project. For example, one subgroup is applying the coding process to the covers of the SF magazines, treating the covers as a separate but closely related cultural genre. Another group is building a historical database to codify the historical environment in which the stories were written. To begin that process, a group of GEP students coded all the cover subjects of *Time Magazine*, from its first issue in 1923, the era of the first SF magazines. The coders through our usual dialectic process developed a list of twenty different categories, from international politics to economics to religion. We then used some novel statistical methods to build a database that quantifies which topics were on people's minds – especially authors' minds – during each calendar quarter of the last 80 years. The goal is eventually to link this new database to the current SF relational database to understand better how the broader historical environments shaped the culture's outputs and conversely how the written works may have shaped the broader culture – a key step in a complex systems approach. We are also using Gallup Poll data, content analysis of election campaigns, and analysis of *The Pittsburgh Courier*, a national black American newspaper, to complement the *Time* cover data as descriptors of the historical backdrop.

During the group meetings, there are frequent discussions tackling inter-coder reliability. For example, deciding among the various values for the outcome field may entail deciding whether or not the main characters represent their societies or merely inhabit them. The boundaries here are fuzzy and somewhat subjective. The GEP team, through its Wednesday discussions, keeps tightening the definitions, expanding the value descriptions, and building decision trees to increase the objectivity of the decision process. Future groups will apply these tighter criteria to previously coded texts and continue to explore ways to increase the objectivity of the coding process.

If our current work continues to be as fruitful as it has been, we expect to attempt parallel studies focusing on other cultural creations, for example, mystery stories, automobile styles, or clothing fashion – using our historical databases to capture the role of changing environments in each case. Our long range goals are to contribute to research and pedagogic methodology, to cultural studies, and to the study of the specific cultural creations we explore.

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9. APPENDIX: CODING SHEET FOR OUTCOME, GENRE CONTENT, GENRE FORM, AND THEME CONTENT

OUTCOME

(effect on implied reader at end of story)

Structural ambiguity

- AMBIGUOUS

Lesson taught

- DIDACTIC

Story fulfills Ideals set out at start

- ROMANTIC

Characters Represent their Society

Breakdown of Social Order

- TRAGIC
(Re-)Establishment of Social Order
- COMIC (establishment is good)
- TRAGICOMIC

Characters Do Not Represent their society

- HAPPY (things work out well)
- SAD

None of the Above

- NOT APPLICABLE

GENRE CONTENT

(what makes the story science fiction (SF))

One or More Individual Characters Make Story SF

Characters are like those in text's normative social world

- MAD SCIENTIST
- PSI POWERS

Characters unlike those in text's normative social world

- MONSTER
- ALIEN

Characters change nature

- CAPABILITY SHIFT - PHYSICAL
- CAPABILITY SHIFT - MENTAL

Social System Makes Story SF

Consequences of disaster

- POST-APOCALYPSE

Steady state system

- EUTOPIA (reader expected to endorse)
- DYSTOPIA (reader expected to reject)
- UTOPIA

Setting Or Its Treatment Makes Story SF

- EXPLORATION
Alternative setting to expected world
- SWORD AND SORCERY
- TIME TRAVEL
- ALTERNATE HISTORY

The salient SF content is an invention

- INVENTION

The narrative defies logic consistent with the reader's

- SURREAL NOVUM

The narrative has no central, salient SF element

- NOT APPLICABLE

GENRE FORM

(Form on which story is built)

Challenge to Reader's Intellect

Abstract issue

- PHILOSOPHICAL TALE

Solve a problem

- DETECTIVE (discover what had happened)
- PUZZLE

Reflect on Known Phenomenon

- PARODY (literary phenomenon)
- SATIRE

Main Characters' Relation to Other Individual Characters

Others are alien

- ALIEN CONTACT

Others not alien

- ROMANTIC
- DOMESTIC

Main Characters' Relationship to Others Via Societal Situation

- WAR (violence or its threat)
- POLITICAL

Main Characters' Relationship to World At Large

- EXPLORATION (uncover information)
- ADVENTURE (accomplish a goal with some choice over actions)
- CRISIS ESCAPE (...with no such choice)

Novel or Story of Education

- BILDUNGSROMAN

None of the Above

- NOT APPLICABLE

THEME CONTENT

(what the story is about)

An Individual or Between Individuals

- HEROISM (voluntary action)
- COMING OF AGE (entrance to adulthood)
- INDIVIDUAL EDUCATION (other change in mentality)
- LOVE

Individual vs. Something Larger (SL)

SL is "setting"

- HOMO RE NATURE

SL is "social circumstance"

- ESCAPISM
- INDIVIDUAL AND SOCIETY

Group-Group Interaction

Relation between groups

- POWER STRUGGLE
 - ALIENNESS/DIFFERENCE
- Development of groups
- PROGRESS
 - EVOLUTION/PATTERN

Larger Than Group (important regardless of individuals or groups)

Abstract skill

- ARTS
 - COMMUNICATION
- Facts, knowledge, ideas
- SCIENCE (observable world)
 - SACRED
 - PHILOSOPHY

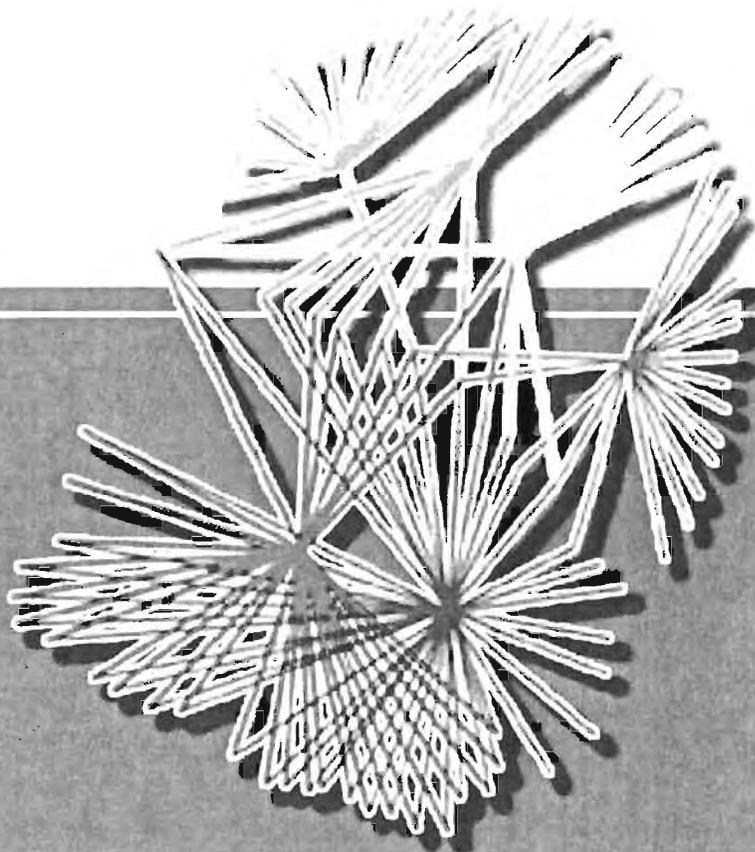


QUADERNI DEL CIG

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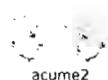
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