

What is Cyberpunk ?

Rudy Rucker
February 1986

Proximately, "cyberpunk" is a word coined by Gardner Dozois to describe the fiction of William Gibson. Gibson's novel *Neuromancer* won the Science Fiction equivalent of the Triple Crown in 1985 : the Hugo, the Nebula, and the Phil Dick award. Obviously, a lot of SF writers would like to be doing whatever Gibson is doing right. At the 1985 National SF Convention in Austin there was a panel called "Cyberpunk". From left to right, the panelists were me, John Shirley, Bruce Sterling, a nameless "moderator", Lew Shiner, Pat Cadigan and Greg Bear. Gibson couldn't make it; he was camping in Canada, and the audience was a bit disappointed to have to settle for pretenders to his crown. Sterling, author of the excellent *Schismatrix*, got a good laugh by announcing, "Gibson couldn't make it today, he's in Switzerland getting his blood changed". Talking about cyberpunk without Gibson there made us all a little uncomfortable, and I thought of a passage in *Gravity's Rainbow*, the quintessential cyberpunk masterpiece :

On Slothrop's table is an old newspaper that appears to be in Spanish. It is open to a peculiar political cartoon of a line of middle-aged men wearing dresses and wigs, inside the police station where a cop is holding a loaf of white... no it's a baby, with a label on its diaper sez LA REVOLUCION... oh, they're all claiming the infant revolution as their own, all these politicians bickering like a bunch of putative mothers...

-- Thomas Pynchon, *Gravity's Rainbow*, Viking, New York 1973, p. 263.

SF convention panels normally consist of a few professional writers and editors telling old stories and deflecting serious questions with one-liners. Usually the moderator is a semi-professional, overwrought at being in public with so many SF icons, but bent on explaining his or her ideas about the panel topic which he or she has chosen. The pros try to keep the mike away from the moderator. The audience watches with the raptness of children gazing at television, and everyone has a good time. It's a warm bath, a love-in. The cyberpunk panel was different. The panelists were crayfishing, the subnormal moderator came on like a raving jackal, and the audience, at least to my eyes, began taking on the look of a lynch mob. Here I'm finally asked to join a literary movement and everyone hates us before I can open my mouth ?

What is it about punk ?

Back in the '60s - now safe and cozy under a twenty-year blanket of consensus history - the basic social division was straight vs. hip, right vs. left, pigs 'n' freaks, feds 'n' heads. Spiro Agnew vs. Timothy Leary. It was a clear, simple gap that sparked and sputtered like a high-voltage carbon arc. The country was as close to civil war as it's been in modern times. News commentators sometimes speak of this as a negative thing - burning cities, correct revolutionary actions, police riots - but there was a lot of energy there. '60s people think of the old tension as "good" in somewhat the same way that '40s people look back on the energy of WWII as "good". A simple dichotomy. But during the '70s times got tough, and all the '60s people got older. Madison Avenue

turned hip into *product*. Businessmen got hot-tubs; and they weren't necessarily faking - I know a number of present-day businessmen who are regular old-time acidheads, but... you've got to get the bread to send your kids to college, right ? The gap between hip and straight is still there, but it's faded, the jags have rubbed off.

If you're young, you want to come up with something new - that's how the race grows. Some '80s youngsters may want to be straights - our country will always need sports fans and prison guards - but the smart ones, the ones who ask hard questions, the same kids who would have been hippies in the '60s - these people needed some kind of stance that would bug *all* old people. Thus punk.

I used to live in the boonies, and LP records were my contact to what was happening. The only good music in the '70s was Zappa, and even he was getting old. I'll never forget the excitement of the first punk records - the New York Dolls, Lou Reed, Patti Smith, Elvis Costello, and then... the Clash. Of course that was all eight years ago (which, these exponential days, is a long time). It keeps mutating. Now I listen to the Ramones, Detox, and the Butthole Surfers. "Yes, the Butthole Surfers". Doesn't that tell you more than, "Yes, the *New Yorker* ?".

The real charm of punk is that stupid hippies dislike it as much as do stupid rednecks. "What's the matter with them ? What do they want ?" Anyone who was ever a hippie for the right reasons - a hatred of conformity and a desire to break through to higher realities - is likely to appreciate and enjoy the punks. But a lot of basically conventional people slid through the '70s thinking of themselves as avant-garde, when in fact they were brain-dead. What's good about punk is that it makes all of us question our comfortable assumptions and attitudes. Wait... look at that last sentence, and you can see I'm forty. How complacently I slip the "us" in there - trying to coopt the revolution. How *Life* magazine of me, how plastic, how bullshit. What's good about punk is that it's fast and dense. It has a lot of information. Which brings us to "cyber".

What is Cybernetics ?

It's the title of an incomprehensible book by Norbert Wiener, mainly. Claude Shannon, the Bell Labs inventor of information theory, encouraged Wiener to use the word "cybernetics" because "no one knows what it means, Norbert, which will always put you at an advantage in an argument". More seriously, if I talk about "cyber", I really want to talk about the modern concept of information.

Mathematics can be thought of as based on five concepts : Number, Space, Logic, Infinity and Information. The age of Number was the Middle Ages, with their nitpicking lists of sins and layers of heaven. Space was the Renaissance, with perspective and the printing press spreading copies out. Logic was the Industrial Revolution, with great steam engines chugging away like syllogistic inferences. Infinity was Modern Times, with quantum mechanics and LSD. Now we're starting on Information. The computers are here, the cybernetic revolution is over.

What is information ? Shannon measured information in "bits". If someone answers a single yes-or-no question, they are giving you one bit of information. Two yes/no questions are two bits. Two bits is enough to distinguish among four possibilities : 00, 01, 10 and 11. The game of Twenty Questions is based on the asker being able to get twenty bits of information out of the answerer. Twenty bits distinguishes among 2^{20} possibilities - about a million. For Shannon, the more possible answers there are, the greater is the information. He estimated written English as carrying about seven bits per word, meaning that if a random word is excised from a text, you can usually guess it by asking seven yes-or-no questions. "Is it a noun ?" "Does it begin with one of the letters A through L ?" "Is it used elsewhere on this page ?" "Is it *cat* ?". In a crap genre book, generated by a low-complexity intelligence with a very short runtime, the information per word is going to be low, maybe as low as three or four bits. In a high-complexity work the information per word will be higher.

Two mathematicians named Chaitin (IBM) and Kolmogorov (USSR) improved Shannon's notion of information to this : the information in a pattern P is equal to the length of the shortest computer program that can generate P. This quantity, also known as *algorithmic complexity*, can be defined quite precisely and rigorously. If I find that a certain SF novel about cats in outer space stupid and boring, it may not just be that I don't like cats. It may be that the book really is stupid and boring, as can be witnessed by the fact that the book has a very low information-theoretic complexity.

The point of all this is *that a pattern's information level is a quantity that is absolute and not relative*. The pattern can be a book, a record album, or a person's conversation. If I say something is boring, it's not just my cruelty speaking. It's objective fact. Something either has a lot of information or it doesn't. And if it doesn't have much information, it's a waste of time.

Now you can see where cyber and punk tie together to make cyberpunk. If you value information the most, then you don't care about convention. It's not, "Who do you know ?"; it's "How fast are you ? How dense ?". It's not, "Do you talk like my old friends ?"; it's "What do you have to say ?". It's not, "Is this comfortable ?"; it's "Is this interesting ?".

Some cyberpunk fiction characters wear punk fashions. This is fine for now, though in the long run it's not the point. As punk becomes familiar, its information content goes down. The essence of cyberpunk fiction, as I see it, is that it is concerned with information. The concern exists on several levels. On the objective level, a cyberpunk work will often talk about computers, software, chips, information, etc. And on the higher level which I was talking about above, a cyberpunk work will try to reach a high level of information-theoretic complexity.

High complexity does not, I should point out, mean hard to read. Shannon has shown that any channel, such as easy-to-read writing, admits of efficient encoding schemes. Inefficient writers waste a lot of page-space in posing, repeating clichés, and telling stupid jokes. If you really have some information to communicate, you can do it in a simple, colloquial way. The hard part is getting the information, building up the complexity levels in your brain. Thus one sees cyberpunks reading a lot : a lot of science, and a lot of fiction. Raising the level.

So what I'm talking about with "cyberpunk" is something like this : literate SF that's easy to read, has a lot of information, and talks about the new thoughtforms that are coming out of the computer revolution. Is "cyberpunk" a good word for this ? Sure. It's easy to remember, and it makes you think. It's an example of efficient encoding. And the association with punks is fine with me. I'm proud to be a cyberpunk.

Postscript to "What is Cyberpunk ?"

After I published this essay, a reader pointed out a flaw in my reasoning, to wit :

If *complexity* is to be the measure of something's value as a piece of cyberized art, then a phone-book is "better" than a novel, because the phone-book's randomness gives it a higher complexity. Recall that "the algorithmic *complexity* of the message M" can be defined as "the length of the shortest program P which generates the message M", (or it can be defined as "the difficulty of guessing what the message M says").

The objection is valid, but I have a good answer. My answer is that I should have spoken of measuring a text's information by its *logical depth* rather than by its *algorithmic complexity*. Let me explain what this means.

There are two sorts of extremes of complexity : the "crystal" and the "gas". A crystal-like information structure is something like a string of a million letter A's. The program for such a message is very short : "print one million A's". So such a message has low complexity. A gas-like information structure is something like a totally random string R of a million letters. The program for such a message is very long : "print the string R" (the lengthy contents of R must be listed for the program that writes it out).

Let me pause here and make a point that we'll need three paragraphs down from here. To run either the "crystal" or the "gas" program takes about the same amount of time. In either case the computer doesn't have to do much work, for the "crystal string", it just prints a million A's, for the "gas string" it just keeps copying out the million letters of R as specified in the program. Each program takes only about a million steps (well, maybe the R program takes two million, but for our purposes one million and two million are about the same size. The point is that they're both a lot less than, say, a billion or a sextillion).

Now note that interesting objects such as living organisms - or cyberpunk SF novels - seem to be lie of midway between crystal and gas. They're organized, but not regimented. They're disorderly but not completely fucked up. How best to characterize them ? It turns out that these desirable objects have the property of having a relatively *low complexity*, but that actually *computing them takes a lot of work*.

To make this precise, we need to introduce a second dimension of information measure. This is the concept of *logical depth* (or simply "depth" for short). The "depth of a message M" is equal to the "*amount of computation* that it takes to generate M from its shortest program P". A structure with a *high depth* may have a short "explanation" or starting program, but it takes a lot of steps to get from the starting assumptions to the final object. Put differently, if you run a high depth process on a computer, it takes a lot of computer time to reach the final result (*).

Now as was pointed out three paragraphs above, a gas and a crystal both have low depth - they result from simple computations. But I claim that a living object - such as an oak tree - is characterized by having a relatively low complexity and a high depth. Why ? An oak tree has a *low algorithmic complexity* because the gene code in its acorn is like a compact program. And the mature oak has a *high logical depth* because of the large number of biocybernetic steps taken during its decades-long growth. We think of an organism's growth as a kind of computation which works out the implications inherent in its DNA.

The wonderful music of the Ramones is a good example of a message with low complexity but high depth. Think in terms of Garage Music. Some guys get a really easy tune - like "Louie, Louie", - and they play it and replay it every Friday, and whenever else they can practice. And after a year, they really play an incredible "Louie, Louie". It's gotten *deep*. On the other hand, a simple note-for-note plagiarism of the Kingsmen's "Louie, Louie" has a low depth - it derives quickly from the Kingsmen program.

Books like *Neuromancer* and *Schismatrix* have a low-complexity/high-depth feel to them. I think it's reasonable to think of them as logically deep, because what the authors have done is to start with some fairly standard SF notions - robots, weird drugs, space colonies - and to then think and think about these notions until the final product is very highly exfoliated.

At this point it begins to look like I'm just saying that good books read as if they've been through a lot of rewrites, which is not such hot news. Still, I do think there is something to this - to the Garage Music notion of SF, if you will - the basic thesis being that right now a good way to be writing SF is to keep going back to the beat old clichés, back to the robots and the brain-eaters and the starships, and to reinvent the field just from that,

by thinking harder and harder about what it can do. Maybe you don't really have to be a "punk" to be stoned, unemployable, and/or stubborn enough to spend enough time in that garage.

In reading fine cyberpunk literature, it's the realness and the tactility of the scene that really matters. In the old *Mad* magazine - and again in the underground comix of the '60s - what was great was all the little things to look at in the frames, the so-called "eyeball kicks". It takes time to work all the little touches out, and that is where we see logical depth, a.k.a. craftsmanship.

Sociologically, the real point of inventing "movements" is to attract attention. At the most, a label like "cyberpunk" can serve only to get people to read the work of individual authors, and at that point the authors are on their own, as usual.

But still... the concept of cyberpunk is energizing. There are other quite different styles of SF, for instance the *transrealist* style epitomized by Philip K. Dick. For a transrealist, SF is a type of autobiography. I was happy, writing *Wetware*, to get away from the transrealism of my book *The Secret of Life* and go for the dense eyeball kicks of cyberpunk.

Cyberpunk suggests, once again, that SF really can be about the world and not just about the author's mind. For me, the best thing about cyberpunk is that it taught me how to enjoy shopping malls, which used to terrify me. Now I just pretend that the whole thing is two miles below the moon's surface, and that half the people's right-brains have been eaten by roboticized steel rats. And suddenly it's *interesting* again.

(*) The notion of logical depth was invented by Charles H. Bennett; see for instance his paper "How to Define Complexity in Physics, and Why" in W. H. Zurek, ed., *Complexity, Entropy and the Physics of Information*, Addison-Wesley, Reading 1989. I also discuss Bennett's ideas in my book *Mind Tools*.