DECONSTRUCTING *ALMOST HUMAN: MAKING ROBOTS THINK*

INTRO: THE ROOKIE REVOLUTION:

A statement nailing the thesis of the book: Something to write at the end—not the beginning when you actually know what the thesis is.

THE NARRATIVE ARC—OR THE FRAME—IN A NUTSHELL

The roboticists imagine, design, build a robot called Zoe. The objective is to prove that robots can find signs of water and life on Mars—without humans—thus they are autonomous—they have vision—connecting themes throughout the book--through the use of specially developed dyes Zoe sprays on the ground. Theoretically, Zoe digs up results and sends data back to Earth to be evaluated by scientists. This is the plan and the shape of the arc. Since the roboticists can't go to Mars, they go to the place on Earth most like Mars: The Atacama Desert in Chile. The story starts there.

PART ONE: THE ATACAMA

Wild Ride to Basecamp: The book begins in the Atacama, introducing some of the main characters—and the setting—the Atacama—and the situation, what's at stake--and Zoe. And me—narrator.

Big Red: We go back in time, discussing the challenge and the problem of the endeavor introducing more main characters, especially a main protagonist, Red Whittaker. History of field robotic development. Carnegie Mellon Robotics Institute. Basic stuff to put it all in perspective.

Groundhog: Going forward in time. How Red was inspired—and an earlier robot he created—Groundhog, to map mines autonomously. Introduction of students—the rookies—and capturing Red in the classroom (well-developed scenes to show in action), inspiring them to do what cannot be done. We meet some of the "rookies." They build Groundhog from scratch.

(This begins a long series of robots/events that focus on autonomy, vision, robots seeing and thinking—side stories and subplots, buy keying in on the focus.)

Bummed and Elated: In the field to test Groundhog, who goes into a mine on its own. First it works—then they lose contact and think they have lost the robot. A couple of hours of agonizing wait later, it reappears. They have to rescue it. Clearly the autonomy codes they have written is subpar. Vision is autonomy—the robot must see to navigate. But Red finds a way to spin the bad to the good. He is a little depressed, however—but we know it will not last.

A Lack of Vision: Back to the Atacama. More about Zoe and the writing of the code to give it vision. But almost immediately during the OPS—this Atacama operation- Zoe cannot see. So what's at stake in another way—focusing on the arc story.

PART TWO: AUTONOMY

RoboCup: Subplot. Manuela Veloso, another main character, figures out why roboticists are stuck—or going too slow in developing code and advancing their field of study. She figures out that roboticists, mostly men, won't work together and share their code. So she establishes an international competition—robot soccer. Developing a team of robots that will play in the World Cup against humans by 2050. You can only participate if you share your code. The men can't resist. It becomes wildly popular.

The Color of Thinking: How the little robots they create learn to think—get vision--much of it is through color coding. Other ways that these robots think are included.

Asimo and Friends: The robots created for RoboCup are small or even off the shelve—but larger, more humanoid robots are here today, in development. This also begins to focus on who is more important, a continuing theme—software writers or engineers—builders.

Frustration: Another robot subplot-GRACE: Graduated Robot Attending a Conference. More about vision software, successes and failures. GRACE can schmoose—but not stand in line. Another continuing theme—lots of progress is being made—but lots more work and success must follow is autonomy will ever be possible.

The Challenge: Back to Red Whittaker--and still another subplot: The DARPA Challenge—an autonomous car race across the Mohave Desert—140 miles. $1 million prize. Whittaker, who was depressed about the failure of Groundhog, is now recharged. CMU refuses to enter, but he goes against them, raises money from the community and once again inspires his rookies to jump in and do the work.

Fresh Blood: More detailed information and character study about the rookies, the challenges they face, the sacrifices they face, the crazy hours, the software they develop—in detail. There's a slow transition from the DARPA Challenge rookies to the Zoe rookies in the Atacama.

PART THREE: THE OPS: Back to the Atacama—where we will stay, ore or less—the Zoe story in full—for most of the rest of the book.,

The Grasshopper and the Ant: A detailed description of Zoe's software. How it works. A dramatization of how to write code for a robot. So here we are no longer talking about the challenges and applications—going much deeper. Deconstructing the process. Code for Sandstorm and the RoboCup robots now compared to Zoe software/code. How robots think comes together so the reader understands the in depth process.

Fallback Positions: Picking up where we left off—Zoe cannot see. Zoe is not working well—even the basic stuff is failing (computer screen, for example), let alone the complicated stuff just described. The mission is suddenly in jeopardy—Zoe has no vision. We go to town to buy supplies—including an old fashioned display and hope that our Atacama brain trust can get Zoe back on its feet.

The Desert Makes Me Wacky: A detailed description of our camp, what we do on the off hours, where we sleep—a tent. More about the team, the orthodox Rabbi, Schmuel, who disappears into his tent on the Sabbath, Dave Pane, never been out of the country before, the mining camp where we eat, toilet tissue—and what we do at night to not go crazy. Basically, keeping the what's a stake factor moving along—but adding context and cinema.

Peeing on a Rock: The roboticists finally get Zoe working—but now the special dyes that have been developed to analyze the soil are not working. Zoe sprays—but nothing happens. This is a gigantic problem. Another what's at stake factor. Again, the mission is in jeopardy. Alan Waggoner, another major character is introduced. The development and functionality of the dyes he developed are explained. He is perplexed. A day or two goes by Wagonner tries everything unsuccessfully. Then he finds the answer when he pees on a rock. And the OPS goes forward. Another way to focus on focus—sometimes luck and the human factor takes precedence over technology.

Downtime after the OPS is over: (One more OPS is in the offing) Back to Carnegie Mellon. Team takes a break, gets ready for the next OPS and analyzes what was accomplished and what needs to be done next.

Two Versions of Reality: A side story—relief from the narrative—having to to with paperwork and the project.

PART FOUR: MAKING HISTORY: A year, maybe more, has passed. Zoe and the software have been perfected. And the team goes back to the final OPS back in the Atacama is about to begin. Overall, six years have gone by since Zoe was imagined and NASA has funded. This is the most important event—will Zoe do the job? Half of the team is back in the Atacama to test Zoe. The other half, including me, is in the mock control center at NASA. This is exactly how it will work when a Zoe like creature goes to Mars—Zoe on its own sending data back to NASA. (NASA is actually not NASA—just a pretend place at CMU.)

Nathalie: Nathalie Cabrol, a famous astrophysicist, is leading the team at NASA. In fact, she is the reason that CMU got the grant to build Zoe—one of the few astrophysicists at the time who actually believed that robots could replace humans on the ground in outer space. Her background, etc. is gone over in depth. She is very much like Red—a true believer. A great spinner. The OPS begins.

Pirate's Cove: The NASA-like headquarters is described, the tension in the air—new team members for this event, etc. Lots of things go wrong in the Atacama—Zoe seems far from perfect—but lots of things go right, especially the way in which Nathalie spins it, and the folks here are satisfied, sort of.

Hardware Vs. Software: This is a debate that has been going on since the beginning—in robotics generally and at CMU specifically. Who and what is more important? The folks who make the robot think or the folks who build the robot and make it move? So here is an analysis of all of the robots we have been discussing and a determination about who wins and loses this hardware-software debate. Also updates on Groundhog, Sandstorm, and the RoboCup robots—kind of finishing off all of these subplots.

In the Field: While it seems like the roboticists and the extended team should be rejoicing because Zoe worked well enough at Pirate's Cove in the Atacama, I conduct a series of interviews of the people who were in the field during these OPS—and find out that lots of stuff that the scientists thought happened successfully did not actually happen without human help. Like Zoe getting stuck in a gulley and the team on the ground pushing it out. Much is up in the air. Can robots really ever become autonomous enough to work in space without human intervention?

The Barest Beginning: Tying up all loose ends and talk about what is in store for the robotics world in the future.