CPSR/Boston Co-Sponsors Debate on Computer Requirements of Star Wars

Jon Jacky - CPSR/Seattle

On October 21, CPSR/Boston and the MIT Laboratory for Computer Science sponsored a panel discussion titled, "Star Wars: Can the Computing Requirements Be Met?" One of the speakers was David L. Parnas, whose resignation last June from the SDI Organization's Panel on Computing in Support of Battle Management (SDIO/PCSBM) attracted national press attention. Other speakers included Danny Cohen, who chairs the SDI computing panel, Charles Seitz, who remains on the panel, and MIT computer science professor Joseph Weizenbaum. Michael Dertouzos, Director of the MIT Laboratory for Computer Science, served as moderator.

Before the event, CPSR/Boston held a reception and fundraiser that was attended by over one hundred people. David Parnas spoke briefly to explain why he felt CPSR was an important organization. "I wouldn't have said that a few months ago," he allowed. He said that CPSR needs to help the public develop more skeptical and realistic expectations about what computers can do. "We like to tell the press about our successes, but not our failures," he said. He also noted that lay people need help distinguishing simple applications from difficult ones. "If you look at the displays of a video game and of a real navigation system, they look about the same," he observed, "but the game can assume that the world is flat, and the navigation system can't even assume that it is round." Finally, he remarked that the existence of CPSR was very important in encouraging people like himself to speak out about problems they encountered in their work. Joseph Weizenbaum added that CPSR needs people to join and contribute.

The debate took place before a capacity crowd of over 1300 people in MIT's Kresge Auditorium. Where else but Boston would it be possible to assemble a technically sophisticated audience this large? At one point, when Michael Dertouzos mentioned that an earlier SDI study panel had suggested a "consistent distributed database," most of the audience laughed. *continued on page 10*

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Dertouzos introduced the speakers and asked that they limit their remarks to the question posed in the event's title, "Can the computing requirements be met?" "It's not the only question, and maybe not even the most important one," he admitted. Dertouzos also credited CPSR/Boston for putting the event together, and introduced Steve Berlin, CPSR Board member and one of the event's organizers.

Parnas spoke first, to explain why he thought the requirements could not be met. He developed the arguments he first presented in the series of eight memos that accompanied his resignation letter. These have been widely circulated in the computing community, and were published in the September/October 1985 issue of *American Scientist*. He said that the ballistic properties of the enemy weapons and decoys, as well as the organization and timing of the attack, could not be completely known in advance. Moreover, the defensive system itself would probably come under attack, and it would not be possible to say which components and communication channels would actually be working when they were needed. He observed that the system would need to meet stringent real-time deadlines, but said that it would be possible for an enemy to organize an attack such that subsystems could be saturated and deadlines could not be met. He recalled that the control programs for Safeguard (an anti-missile system developed and then abandoned in the early 1970s) were designed to sacrifice some targets when they became saturated. "That may be okay for hard-point defense of targets like missile silos, but it is unacceptable for population defense," he noted. He said that an enemy that understood how the software was supposed to work could always design an attack to exploit its weaknesses, and observed that the system would require the efforts of thousands of programmers for many years. "I'm worried that one of them will be named Walker," he said, alluding to the recent espionage case. Otherwise, he noted that most of his criticisms did not depend on the size of the system.

Parnas concluded that we could never be confident that the system would work if it was needed. Therefore, we would feel compelled to retain our offensive nuclear arsenal. The Russians, on the other hand, would have to assume that the system might work. To maintain deterrence in the face of our offensive weapons and anti-missile shield, they might proliferate offensive missiles, or shift their emphasis to air-breathing bombers and cruise missiles. "I am really concerned we could end up in a very disadvantageous strategic posture," Parnas said. "I am for a strong defense, but this is a poor defense."

Joseph Weizenbaum spoke next. He explained that there were three classes of impossible systems. First, systems prohibited by first principles, such as perpetual motion machines. "We hardly have any first principles in computer science, so this isn't relevant here," he said. Next, systems which are syntactically impossible, like a computer program that is supposed to satisfy a set of specifications kept secret from the developers. Finally, systems which are possible in principle but impossible for practical purposes. "In principle, there is no reason why 5,000 monkeys pounding on 5,000 typewriters could not produce the *Encyclopedia Brittanica*," he said, explaining that SDI was a bit like that. "On the other hand, it is pretty easy to tell if the monkeys succeeded," he observed.

Weizenbaum also observed that SDI was an attempt to transform the politiical problem that exists between the United States and the Soviet Union into the technical problem of stopping missiles. He said that even if we could succeed in that, most of our problems would still remain or would reappear in some similar form. "It is important that members of the technical community say this," he said.

Charles Seitz of Caltech argued in favor of SDI. He said that SDI was a research program, not a development program; the point was to determine whether it was feasible or not. "They cancelled the Sergeant York, and they would cancel SDI too if it became clear it wouldn't work," he said, referring to the computer-controlled anti-aircraft gun abandoned this summer. Seitz emphasized that "We don't even know what the requirements are yet. We will have a much clearer idea in a year or so," he said. Seitz read the conclusion from the SDIO/PCSBM interim report, which said that selecting an appropriate system architecture was the key to the problem, and was much more important than selection of a particular software engineering methodology. The interim report warned that selecting a new and untried development methodology might put the whole project at risk. Furthermore, Seitz emphasized that the earlier Fletcher Panel report, which first made the now-famous estimate of 10 million lines of SDI code, and suggested the "consistent distributed database" which evoked such mirth, was not a requirements document, and the architecture described there was presented merely for purposes of example. To show how architecture might help, Seitz drew a tree diagram of the sort familiar to readers of computer science texts. Indicating the terminal nodes, Seitz explained that raw sensor data would be represented down there, then would be abstracted and passed up to the intermediate nodes, and further abstracted and passed into the root, where high-level processing, such as the allocation of weapons to targets, would occur. He argued that the code at each level would be relatively straightforward.

The last speaker was Daniel Cohen, Chairman of SDIO/PCSBM. He said he would debunk "Parnas' octet," referring to the eight memos. For example, he said that Parnas' claim that we would not know the ballistic properties of decoys in advance was the same as claiming that F does not equal M *x* A (and thus denies the basic law of motion). Cohen also pointed out that the SDI computing requirements did not violate any fundamental principles like the halting problem, and in any case it was not yet clear what the requirements were. "We may be able to define the requirements so that we can do it," he said. Cohen cited other very large computer systems, including the telephone switching system, the 747 airliner avionics, the Space Shuttle, and the Apollo moon project. "They all worked well enough," he noted. Writing in symbolic algebraic notation, Cohen said Parnas had not proved that "For every SDI, SDI is not feasible," but only that "There exists an SDI which is not feasible." Cohen also complained that Parnas left the panel after only two days, while the other members worked on their report for 18 days. He cited SDI's policy and ethical advantages, saying, "they should even like it in Berkeley," illustrating his point with a slide of a bumper sticker with the slogan, "Kill bombs, not people," festooned with drawings of flowers. Cohen also mentioned that he thought that the Department of Defense did a good

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job of funding computer science research. Finally, he said, "There are concerns about false alerts, but I would much rather have false alerts in SDI than with Mutual Assured Destruction."

Then followed a series of rebuttals by each speaker. Parnas said that SDI was not being presented as a research project, but a development project. He cited a memo from Defense Secretary Caspar Weinberger to SDI Director Abrahamson to support this. Furthermore, he said he had asked one of the SDIO/PCSBM organizers if it was acceptable for the panel to conclude SDI could not be done. No, he was told, it was not acceptable. The person to whom this statement was attributed lept from the audience and yelled, "I never said that!" Parnas cried back, "You did too!" Dertouzos intervened to stop the shouting match.

Parnas also said that the requirements of SDI were quite clear: make nuclear ballistic missiles "impotent and obsolete." He said that if the SDIO decided to take on something less ambitious "there need to be speeches by Reagan, Weinberger and Abrahamson to make that absolutely clear to the people." Weizenbaum also complained that the SDIO panelists were trying to make a transformation from what Reagan promised to what they thought they could do.

Parnas also noted that the examples of successful large systems cited by Cohen did not have to meet the same kinds of reliability requirements that SDI would have to meet. "The reason the Shuttle works is that we can turn it off when it doesn't," he said.

Weizenbaum expressed disappointment with Cohen and Seitz. "They haven't responded to any of the criticisms which David or I have made," he said.

After the rebuttals, the speakers responded to questions from the audience. Someone asked, "How could you quantify the SDI system reliability, so people could decide whether they thought it was good, bad, or in-between?" Seitz said that since all components of the SDI system would pass over the United States for large periods of time, there would be ample opportunities for quite large-scale realistic tests.

Someone else asked Seitz, "What kind of architectures would make the problem more tractable? We could use them now!" Seitz replied that the system could be limited to only certain kinds of communication.

Someone asked if electromagnetic pulse from nuclear explosions would harm the SDI electronics. Seitz said that electromagnetic pulse was only experienced within the atmosphere, not in space. "However, the large flux of neutrons might scramble the contents of dynamic memory, so in that case you might have to reboot the system," he said to gasps and astonished laughter. "How can someone say something like that and still claim it might work?" Weizenbaum asked.

Someone commented about Cohen's statement that SDI violates no fundamental law of computing, "Yes, but it violates Murphy's law!" □

CPSR in the News

John Markoff, "Superweapons: The Defense Boom in Silicon Valley," *San Francisco Examiner*, August 11-13, 1985, p. 1. An excellent three-part series on the defense electronics industry in Silicon Valley. Quotes CPSR Executive Director Gary Chapman.

J.E. Ferrell, "Disarming Computers," *San Francisco Examiner*, August 19, 1985, p. B-7. An article about CPSR, featuring quotes from and a picture of Gary Chapman, and quotes from CPSR/Palo Alto Chapter Secretary Dave Caulkins.

Associated Press, "Pentagon Hopes Computers Will Someday Fight Battles," August 25, 1985. A wire-service story on the Strategic Computing Initiative and the International Joint Conference on Artificial Intelligence. Quotes CPSR National Chairman Severo Ornstein.

Brian Robinson, "Is DARPA Plan Too Ambitious?", *Electronic Engineering Times*, August 19, 1985, pp. 1, 12-13. Fifth and last article of a series on the Strategic Computing Initiative. Quotes Gary Chapman.

Kathy O'Toole, "Computers' War-Making Power Feared," *Oakland Tribune*, October 13, 1985, pp. 1-2. An article on the SDI, Strategic Computing and CPSR. Quotes Gary Chapman and CPSR/Berkeley member Clark Thompson.

Ken Haldin, "Defense-Related Topics Focus of Network," *Los Angeles Times*, October 15, 1985, Part IV, p. 20. An article about CPSR/LA, with interviews with CPSR/LA Chapter Secretary David Booth and Chairman Rodney Hoffman, and Gary Chapman.

David E. Sanger, "A Debate About Star Wars: Can Software Be Designed?", *New York Times*, October 23, 1985, pp. 25, 31. An article about the debate at MIT organized by CPSR/Boston. Features quotes from and pictures of CPSR members David L. Parnas and Joseph Weizenbaum.

Leon E. Wynter, "Defense Agency's Research Role Stirs Debate," *Wall Street Journal*, October 24, 1985, p. 6. An article about DARPA and its current funding priorities. Quotes Gary Chapman and CPSR/Palo Alto member Doug Englebart. □

OOPS!

To provide some relief from the seriousness of the issues which CPSR regularly addresses, we offer this column which contains true stories of computer faux pas. Send us your favorites and we will select, edit and publish.

San Francisco Chronicle columnist Herb Caen recently published this item sent in by a reader. The man had received a computer-generated bill. At the top of the bill, in typical high-speed dot-matrix print, it said, "Due to a computer error, the following figures are correct."