The Future of Dispatching
Artificial Intelligence Voice Recognition Computers

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The Command College Futures Study Project is a FUTURES study of a particular emerging issue of relevance to law enforcement. Its purpose is NOT to predict the future; rather, to project a variety of possible scenarios useful for strategic planning in anticipation of the emerging landscape facing policing organizations.

This journal article was created using the futures forecasting process of Command College and its outcomes. Defining the future differs from analyzing the past, because it has not yet happened. In this article, methodologies have been used to discern useful alternatives to enhance the success of planners and leaders in their response to a range of possible future environments.

Managing the future means influencing it—creating, constraining and adapting to emerging trends and events in a way that optimizes the opportunities and minimizes the threats of relevance to the profession.

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Most everyone has called a business such as an airline or utility company seeking assistance, where questions are posed to them by a computer instead of a live person. The caller's spoken answers are understood and then acted upon by that computer. Do you remember the computer "Hal" in *2001: Space Odyssey*?[1] Many times, the computer has a pleasant sounding voice like "Hal" and almost sounds like a real person. Contemporary computers do not have the capabilities of "Hal"; however, computers and humans can now communicate through speech recognition technology.[2]

Private Industry has been utilizing Artificial Intelligence Voice Recognition (A.I.V.R.) to answer telephones for years to conduct everyday business. The top providers of telephone-based speech-recognition solutions boast over thousands of deployments of their technology by various partners in the years between 1997 and 2002.[3] Businesses have discovered A.I.V.R. computers can save thousands of dollars in employee costs while still providing sufficient levels of customer service. The public continues to have a high demand for police services, and governments continue to look for ways to provide it, while curtailing costs. So those of us in policing need to ask ourselves: why hasn't law enforcement given Artificial Intelligence Voice Recognition Computers consideration to answer and dispatch calls for service?

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[1] 2001: A Space Odyssey, accessed May, 26, 2008, accessed http://kubrickfilms.wanrebros.com

[2] Artificial Intelligence, Human Enablement, (2003) accessed June 26, 2007, accessed www.human-evolution.org

[3] Blade Kotelly 2003, " The Art and Business of Speech Recognition", Addison-Wesley, Page 7 data from Nuance Communications Inc. and SpeechWorks International

Communications: Past, Present and Future?

As technology continues to improve, computers are taking over more and more human roles. Major businesses such as Federal Express, United Parcel Service, American Airlines, Sears, Nike, and Ticketmaster are using voice-recognition computers to replace staff, and save money.[4] But what if those same computers could be used to replace call taking and dispatching functions in law enforcement agencies? Instead of a human dealing with a call for service, a computer could receive calls from the public. Imagine if non-emergency calls could be received and dispatched by a computer. What if the computer could actually obtain the information from the caller, then send the call out to the mobile data computer in the nearest available police car? The technology is already available today to accomplish this goal.

Police communications have evolved tremendously since the late 1800's, when police used a red signal light as a form of communications to the officers. The lights were laced on top of a building at a key intersection and when the officers saw the red light lit up; they knew to contact communications for an assignment.[5] A lot has changed since those red signal light days. Mobile radios, portable radios, Computerized Automated Dispatching (C.A.D.), mobile data computers (M.D.C.'s). A computerized Artificial Intelligence Voice Recognition System used to answer non-emergency telephones is the next logical step, and technology is present and available. This article presents information to convince you that this step can occur today.

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[4] Ibid

[5] "The History of Police Communications", by Supervising Public Safety Dispatcher Carol Fleischer, (2000), accessed June 22, 2007, available: www.ci.irvine.ca.us/ipd

Considering the rapid development of artificial intelligence computers and speech recognition technology, their role in business and society is expanding. Humans are utilizing conversational speech technology on a daily basis. Passenger vehicles have been developed with voice recognition technology that activates climate control, navigation systems, and retractable roofs. Ford Motor Company already has advanced conversational speech technology, which allows dialogue with your vehicle [6]. The conversational interface has a vocabulary of over 50,000 words so far, and speaks when spoken to. [7]

Advantages of Speech Recognition Technologies

A Speech Recognition Computer never gets tired, never forgets what it learns, needs time off, vacation or benefits, can be programmed to speak different languages, never gets angry and can answer many different calls at once. It acts upon words that a person has spoken. It has the ability to ask a direct question, and then act on the response. In fact, a representative north American English speech-recognition system such as the one used by United Airlines is so good that it can match a single spoken word against a list of 80,000 items with upwards of 95% accuracy while still being able to reply to the caller with the next question or statement in tenths of a second. In the first 30 months after United Airlines deployed their speech-recognition flight information system, the system handled over 50 million calls and United Airlines saved over $24 million dollars. [8]

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[6] Ford Motor Company Voice Recognition, (2007), Ford Motor Co. accessed June 26, 2007, available: http://www.ford

[7] Ibid

[8] Blade Kotelly 2003, " The Art and Business of Speech Recognition", Addison-Wesley, Page 2

Australia's Postal Service contact center just implemented a speech recognition center for incoming calls. This has reduced call costs by eighty percent and has allowed Postal Staff to be transferred to more complex tasks. The center receives 10,000 calls per day, of which 1,500 are now answered by the speech recognition system. Customers get their calls answered much quicker by the computer, usually within one second and with no hold time. Calls are dealt with in a shorter time period too; average time saved is approximately forty-five seconds per call.[9]

Speech-recognition technology can overcome many of the technical limitations associated with touch-tone systems, but must be used the right way, for the right customers, to solve problems. Speech recognition systems listen to what a person says and then attempt to match the statement with a known list of words. The systems are tested to make sure they can recognize all possible responses from the caller. By 2010, through its "Super Human Speech Recognition Project," IBM hopes to develop commercially viable systems that can transcribe speech into written text more accurately than humans.[10]

According to Chris Johnston of Locution Systems, which builds automated voice dispatching systems, "The computer industry is already moving in the direction of computers receiving and dispatching calls for service. Research is being conducted into possibilities of building a system that interfaces with Computer Automated Dispatch Systems." According to Johnston, some of the obstacles a system would face are:

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[9] Ibid

[10] "Talking computers nearing reality", by Michael Kanellos, (2003) Staff Writer, CNET, accessed 05-26-08, http://news.cnet.com

- Interfacing with Computer Automated Dispatching Systems already in use
- Dealing with the voice recognition of an excited caller.
- Understanding a caller, such as someone with a thick accent
- Integrating traffic patterns and weather conditions
- Incorporating GPS system information on locations of patrol cars
- Determining police unit availability

Johnston noted the technology to mitigate these problems already exists. The problem is finding a way to integrate it. One issue to be resolved, for instance, is the manner in which a human might "take over" if the computer didn't understand the caller, or if the call required a complexity of response beyond the computer's capacity. Bill Richardson, also from Locution Systems, added, "Parameters are already being explored regarding this topic. We are looking at key word recognitions that can be programmed into the system where, if the computer hears the word or phrase, it would immediately transfer the person over to a live person. This would hold true if the computer sensed the person was under a large amount of stress."

According to Johnston, there is software already available that recognizes voice stress, such as a voice stress analyzer. Both Johnson and Richardson agreed that, initially, such a system would only be used to handle non-emergency calls. Johnson and Richardson believe as the price comes down and the technology improves, we will likely see such a system within five years, with an estimated cost around $750,000 to $1,000,000.000 for an agency serving around a population of around 100,000 people. Richardson stated the technology is in place. The task ahead is the programming to match capability with specific requirements.

SunridgeSystems builds records management and computer aided dispatch systems for a public safety agencies. John Boren, the Chief technology officer, agrees with Johnston and Richardson's assessment. His company currently works with another form, Coplogic, which builds on-line citizen reporting systems. This system allows the public to write and submit their reports on line. Boren sees the biggest issue for A.V.I.R.D. as the "script" for the computer to allow it to recognize what the caller is trying to communicate, and then being able to transfer that data into C.A.D. The volume and extent of the information desired from the AVIRD will determine costs to develop and implement. SunridgeSystems already has mobile data computers deployed that speak to officers. They are already working on similar units that allow the officer to speak to the computer. The biggest problem so far has been outside interference such as the police radio and car radio.

Johnston, Richardson and Boren all agree that speech recognition has come a long way, but still has a long way to go. They also agree that as technology continues to improve, speech recognition and its role in general law enforcement is possible within the next five years.

Speech Recognition

Carnegie Mellon University has been researching Speech Recognition as a component of theoretical developments in linguistics, representation, search and machine learning. Carnegie Mellon University has been focusing on realistic, complex problems with speech recognition. Researchers at the university have been looking at everything from phones, words, continuous or connected words and most recently spontaneous

speech. Research is continuing on emphasizing dynamic and automatic model adaptation to speaker, channel, noise, accent, pronunciation, speaking styles, and dialogue.

The University's researchers discovered that telephone audio quality still poses a problem for speech recognition systems, such as a bad cell phone connection. Computers also have difficulty knowing when to listen, and when to stop listening, which can pose a challenge. "Language Models that can automatically adapt to detect changes in vocabulary, topic, and speaking style are being developed".[11] Wade Rousch, former editor of MIT's Technology Review writes, " I am compelled to report that speech recognition is taking a real lurch forward", after he was given a demonstration of the new Harvard square startup Vlingo, which uses a cell phone based voice recognition system. He wrote that it not only works, but also gets more accurate as more people use it. [12]

Steady advances in technology have made researchers more confident in speech recognition technology. Unfortunately, current systems, which corporations such as United Airlines, Nike and various banks use, cost around one million dollars; so many governmental agencies could not afford that figure at the present time.[13] Or could they? Amtrak paid $4 million dollars for their natural voiced artificial intelligence speech recognition system, which they call "Julie". According to Matt Hardison, Amtrak's Chief

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[11] " Speech Recognition: Past, Present, and Future" a Carnegie Mellon University Perspective by Kevin Lenzo, Paul Placeway, Kristie Seymore, Mathew A. Siegler, available at http:// www.cs.cmu.edu

[12] " Vlingo's Adaptive Speech Recognition Promises an End to Typing on you Cell Phone", Wade Rousch, accessed 08-21-08, http://www.xeconomy.com/2007/08/21

[13] "Newsmaker: The future of talking computers ", Oct 13, 2003, cnetnews, available http://news.com.com

of Sales Distribution and Customer Service, they recouped those costs in only 18 months due to salary savings. [14]

According to speech recognition researcher Kai-Fu Lee, former researcher of Carnegie Mellon University and computer scientist for Microsoft, speech technology has made great progress, and he believes in the near future it will reach or exceed human-level performance. According to Lee, the most important future agenda is to build computers with speech recognition technology that are affordable. People must also learn to talk to computers appropriately; he believes this will happen over time, definitely within the next ten years.[15]

An Expert Panel Weighs In

A panel of local representatives was assembled in Eureka, California in August 2007 to examine the possibility of law enforcement utilizing an Artificial Intelligence Voice Recognition (A.I.V.R.D.) computerized dispatch system. The panel was comprised of a private attorney, a union labor representative, a county supervisor, a city personnel employee, a county computer information technology (I.T.) managing supervisor, a supervising law enforcement dispatcher, an office of emergency services supervisor, an assistant city fire chief, a real estate broker and a security alarm specialist.

The panel concluded that an artificially-intelligence voice recognition dispatch system might be in the future for law enforcement and the communities they serve. Utilization of such a system would need to be managed with caution. Public acceptance could be an enormous hurdle. This would be especially true for the older

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[14] "Ernestine, meet Julie", CFO: Magazine for Senior Financial Executives, accessed 05-26-08, http://findarticles.com

[15] "Newsmaker: The future of talking computers ", Oct 13, 2003, cnetnews, available http://news.com.com

generations who are not used to computer technology. The panel's consensus was private businesses seem to be utilizing voice recognitions systems more and more to save money. Questions arose regarding the risks of the benefits of such a system versus the financial, moral and political costs. Any system put into use should be carefully screened for potential problems, and some sort of break switch should initially be available to the public. Over time, the system could very well prove itself reliable and beneficial to everyone.-

In the round table discussions held by the panel the members repeatedly thought if the systems developers learned from negative events, it could actually be used to improve an AVIRD system's reliability. They also repeatedly said if the system performed well in a natural disaster situation or a terrorist attack, it would be a strong selling point. If the system was susceptible to being "hacked" and lives were at risk or their private information was exploited, that could have a significant negative effect on the public's acceptance of such a system. Overall the panel believed that an A.I.V.R.D. system was likely to be utilized for law enforcement in the near future, and if the system worked correctly, it could be a big benefit for governmental agencies and the citizens, which they serve.

As envisioned by planners and vendors, A.I.V.R.D. systems would generally be utilized to answer non-emergency calls for service. A majority of calls, which law enforcement agencies receive, are not emergencies. Supervising Dispatcher Cheri Williams of the Humboldt County Sheriffs Office, in Eureka California has been dispatching for twenty years and estimates the number of non-emergency calls dispatchers receive at 85%. Even with existing technologies in use in other business

sectors, an A.I.V.R.D. system could answer phone calls utilizing the natural voice system such as being utilized by United Airlines or Amtrak. The system would initially ask the caller if they had an emergency, if so the system would be programmed to forward the caller to an emergency dispatcher. Otherwise the system would be pre-programmed to ask the caller the most common crimes that occur, such as if they were reporting a theft. If that was what the caller was reporting, the system would ask the caller a series of pre-programmed questions regarding the theft, such as location of occurrence, suspects, type of item(s) stolen, known weapons.

Just like private industries computers, the law enforcement A.I.V.R. D. computer would clarify responses by the caller. If the computer could not understand the caller due accent, etc. it would ask the person to hold for the next available call taker. If it understood the caller, the system would enter call information into the Computer Automated Dispatch System (C.A.D.), and automatically dispatch the call to the field police officer's onboard computer. The computer could automatically run wants, warrants, drivers' license and previous address history of any suspect information that had been provided by the reporting party. If the beat officer had further questions, they would have the victim's telephone number available, and could call them from their cell phone. Such a system could also be pre-programmed to answer questions that call takers typically answer, such as "what is the telephone number for the jail?"

Utilizing an A.I.V.R.D. system will require a strategic plan that will include goals and a system evaluation. The Chief of Police or the Sheriff of a law enforcement organization will be the leader in getting such a system implemented. If such system were already tested by a law enforcement agency and performing as designed, then "buy in" of

the community and it political representatives would be much easier. Being a “test agency” however would require much more convincing of the general public, and community leaders. Having achievable and verifiable goals for implementation of the system should be a priority. Partnering with the private sector would be crucial in trying to sell the system to the community.

Once an A.V.I.R.D. system is installed a system of evaluation its effectiveness will be needed. The specific areas to be evaluated and compared with past performance are:

1. **Financial Cost-** Will the benefits out weigh its costs? Using previous budget years as a baseline for comparison. There would be an initial start up cost, however over the course of a few years is the agency saving money by reducing or reassigning personnel.

2. **Performance-**. Are calls for service being dispatched quicker, accurately, effectively with appropriate information compared with average dispatch time and caller hold time prior to the change being implemented?

3. **Dispatchers/ Call takers-** Is the agency able to do more with less? Is the agency able to dispatch more calls for service with less employees after the change? Is the stress level for dispatchers increasing or decreasing with implementation of the new system and why. Is it decreasing due to call load being removed? Or is it increasing due to

misroutes, and system failures. A log will need to be created regarding misroutes, complaints about the system.

4. **Officer Safety-** How do the officers rate the system? Are the officers receiving the information needed in a timely or quicker time frame prior to the change? Are the officers getting needed information and accurate information? A survey of officers, and their supervisors regarding the system, its performance and accuracy will need to be conducted.

5. **Community Response-** How is the community accepting the new A.I.V.R.D. change? Are they satisfied with the system and are citizen complaints regarding timeliness of calls be answered increasing or decreasing from previous years. Is the information being relayed callers to computer system getting appropriately entered? Have there been any misroutes, if so how many and why? A random follow up survey by either personnel or mailers to ascertain what the community thinks about the system would be extremely beneficial and an excellent tool to measure the communities evaluation of the change.

Using these parameters for evaluation should give a clear picture as to how the change is being received, and its success or failure. If there are failures, can those areas be turned into successes? Those areas that are not performing as designed will need to be corrected or improved upon. The most difficult issue with such a system as A.V.I.R.D. is

dealing with our own paradigms. As previously mentioned United Airlines and many other companies already use such a system. Based up my research I have discovered that these systems can be programmed to answer and deal with a variety of situations. What is the difference between a computer asking a person, “Do you want to fly domestically or internationally?” versus “Is this in progress?” If the caller answers yes, they could be transferred to a live person. “Do you want to report a theft or an assault? Yes or No”, or “Is you address 1313 Main Street, Strawberry Creek, California, and is your phone number is 707-845-1414?” The computer could be programmed to ask a wide variety of common questions which call takers and dispatchers handle daily. With the advent of caller ID, many times the name and address is already available. A successful call taken could be immediately dispatched through C.A.D. to a patrol car’s Mobile Data Computer. With cell phones so readily available, officers could contact the caller if they had further questions prior to arrival. Some callers could be directed to a website that allowed them to enter their own call for service. Think of the possibilities available.

Some might argue that such a system is too much for the public to handle. The public initially frowned upon Automatic Tellers, Automatic Air Traffic Control, Automated Check Out kiosks, Automated Banking, and a host of similar systems. Of course, now they are used daily as a part of life.

Conclusion

With employees becoming more difficult to find, train, and pass backgrounds, A.I.V.R.D. may very well be an answer for the staffing needs of public safety dispatch centers. Considering that health care and other employee costs are rising, and

governmental budgets are shrinking, A.I.V.R.D. seems like a logical step. Generation X and Y have grown up with computer technology, and many have not lived without computers. Their acceptance of this change will most likely be much less stressful than that of the baby boomer and older generation. Utilizing an A.I.V.R.D. system in at least a limited role, can save law enforcement time, money, and free up our limited staffing. A limited use A.I.V.R.D. to answer non-emergency calls will help reduce staffing, provide consistency and may very well become common place in the near future, 2001 Space Odyssey is the here and now. The A.I.V.R.D. could be “HAL”.