PATROL CARS OF THE FUTURE: A CAR WITH A VOICE

Are we there yet? Can Voice Recognition Technology for law enforcement save lives?

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The Command College Futures Professional Article is a 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 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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Imagine a scenario in the very near future…an officer on uniform patrol watches as a vehicle speeds by. The onboard facial recognition camera recognizes the driver of the vehicle; other onboard systems obtain registration information from the license plate. The suspect is wanted in connection with a serious crime, suspected of abducting a child. The officer says "pursuit.' Automatically, the police car's blue lights, siren, flashing headlights and video camera turn on. The car's data systems send a message to dispatch, requesting assistance, providing real-time location, and also controls traffic flow through a traffic management system that overrides signals along the route for maximum safety to all vehicles on the roadway. During the pursuit, the officer obtains updated information; he requests it verbally from his vehicle that, in turn, will answer each request throughout the extended pursuit. All this, and the officer never takes his eyes off the road (or suspect) and keeps his hands on the steering wheel instead of fiddling with switches, buttons dials or microphones. Imagine how much more safely the officer's driving environment could be, if the technology truly worked this way. Since current and emerging technology could allow such a speech interface with a police vehicle's equipment, one might wonder why law enforcement has not already equipped them that way. If they did, it could have a dramatic impact on the lives lost in the policing profession.

Traffic Collisions pose the greatest known lethal threat to law enforcement officers (LEOs). On duty traffic collisions are the leading cause of death for LEOs in California and nationally, and have been since 1990 (NHTSA). LEO deaths from traffic collisions cost the federal, state, and local governments more than $100 million each year (NHTSA). One of the smallest, but most dramatic, costs associated with these fatal traffic collisions is the amount paid out to the survivors and beneficiaries ($300,000 each)

totaling nearly $20,000,000 annually (NHTSA). These numbers are substantial, but the full economic cost of collisions involves many factors. Considering lost productivity, legal costs, court and property damage costs, based on National Highway Traffic Safety Administration calculations for a fatal traffic collision, by today's standards costs nearly 1.9 million dollars each.

What is not measurable is the grief and personal loss felt by families, friends, colleagues and communities. Further, innocent citizens are often involved in a LEO collision, and frequently incur their own personal and financial losses. The cost to others is difficult to capture statistically, but could easily be as significant as that known for the police (Post.ca.gov, Justification 2009).

Several manageable variables contribute to LEO traffic collisions. Examples of these variables include policy, training fatigue, distraction, supervision, management, and culture. There are, though, emerging technologies that could substantially reduce at least one of the primary causes of these incidents. There are intelligent systems already being placed in passenger vehicles on the roadways today.

One of the most promising for law enforcement use would be to supplement existing technologies in the patrol car with comprehensive Voice Recognition Technology (VRT) to manage driver distraction and enhance communications by changing the current methods by which it is obtained through manual dexterity. What if voice recognition technology became a reality in the not too distant future as a tool to eliminate driving distractions for patrol officers? If utilized as envisioned, VRT could potentially save lives and millions of dollars associated with LEO traffic collisions

(Post.ca.gov, Overview 2009). On the pages that follow, we will discuss what VRT is, the way it might be used for policing, and what the future holds.

Are we there yet?

Voice Technology

Research indicates that as many as 80% of collisions are caused by distracted drivers (Wilkinson, Brian 2013). Distraction can be divided into many categories. The most basic are "Internal" (e.g., thinking about what is happening at the scene you are responding to) and "External" (e.g., manipulating the radio or MDT). Combining internal and external distractions compounds the likelihood of a collision. The amount of multi-tasking a peace officer driving an emergency vehicle undertakes is significant (consider radios, scanners, computers, lights, sirens), and is far beyond the normal distractions experienced by any other driver on the road. Although, officers have used the police radio for decades to send and receive information, the contemporary police car has little else that does not require tactile interaction. The pace and direction of technology, though, offers a significant change in the way the police optimize the technologies they use, and will use, in the future.

Technological curiosity to automate simple tasks inherently requiring human-machine interactions and research in automatic speech recognition by machine has attracted a great deal of attention for decades (Juang, B.H. & Rabiner, Lawrence R., 2004). Scientists predict that everything we know about computers will change within this decade, and by 2020 and an individual will have the ability to have an intelligent conversation with the average computer (Kurzweil, Raymond 2005). With increased concerns nationwide about technology-burdened drivers, the hands-free communication

movement has spurred technology and legislation to eliminate the distraction of hands-on cell phone usage while driving. It is important, though, to find ways voice technology can help officers communicate more safely and effectively. (Foreman, Kelly, 2010). Artificially Intelligent Voice Recognition Technology (VRT) and its advancements are key elements to achieve the next level of human-machine interaction for the police.

VRT

Voice recognition is "the technology by which sounds, words or phrases spoken by humans are converted into electrical signals and these signals are transformed into coding patterns to which meaning has been assigned" (Adams, Russ 1990). While the concept could more generally be called "sound recognition", we focus here on the human voice because we most often and most naturally use our voices to communicate our ideas to others in our immediate surroundings.

Substantial efforts have been devoted in the last decade to the test and evaluation of speech recognition. Of particular note is the U.S. program in speech recognition for advanced Fighter Technology Integration in aircraft (Klie, Leonard 2007). In these programs, speech recognizers have been operated successfully in fighter aircraft, with applications including: setting radio frequencies, commanding an autopilot system, setting steer-point coordinates and weapons release parameters, and controlling flight display in platforms such as the Apache Helicopter, F-18 and F-22 this allows pilots to concentrate on maneuvering their plans and not pause that focus to flip switches. It has also been tested air traffic controllers, telephony and other domains. The improvement of Mobil processor speeds made feasible the speech-enabled Smartphone. The most common mobile operating systems (OS) used by modern Smartphones include Apple's

iOS, Google's Android, Microsoft's Windows Phone, Nokia's Symbian, RIM's BlackBerry OS, and embedded Linux distributions such as Maemo and MeeGo (Smartphone Speech 2012).

Advancing automated speech recognition's implementation into law enforcement too quickly or before it the technology has advanced to a reliably proficient level, though may prove ill fated. Humans are often resistant to technology advances when forced upon them, and the specific technology proves difficult to use or implement. For instance, when Apple released SIRI on the I phone 4s in late 2011, it was thought that voice recognition at this level would gain widespread acceptance. While SIRI is one of the most advanced voice interaction software systems, it is not perfect. For instance, it has trouble with longer word phrases and appears confused with short requests such as 'nearest or coffee shop'. It does, though, offer a glimpse of what is possible in the future (Bassin, Craig, 2011).

VRT for Law Enforcement

In today's fast paced and technologically well-informed society, multitasking is necessary, especially for law enforcement officers (Foreman, Kelly, 2010). Artificial Intelligence (A.I.) programs have been able to tackle new problems using old methods with great success. A.I. has contributed to the state of the art in many areas, for example speech recognition and machine translation (Lohr, Steve and Markhoff, John, 2010). The combination of AI and speech recognition may prove to be the "next step" to the way the police use their in-car equipment.

In-car computers utilized by law enforcement today that have voice command capabilities are growing in both number and acceptance. New Hampshire, North Carolina, Maryland State Police, Michigan and California agencies continue to look for ways to increase efficiency as well as officer safety by testing voice-recognition technology systems (Foreman, Kelly, 2010). These systems use a variety of standard voice-recognition programs, though officers can still operate equipment by hand. Current systems provide voice interface with Mobil Data Computers (MDT) that operate a variety of equipment, computer, lights, siren, radio etc... Patrol vehicles benefit by eliminating the physical manipulation of the systems by allowing officers to refocus on driving, situational awareness and planning, for what they might encounter at their arrival destination or along the way.

Computers and other devices are implemented as a way of increasing efficiency but on many levels, they have also increased individual officer distraction levels through their manual manipulation. This is evidenced by reported accidents involving this type of distraction. One has only to review news reports across the nation and see it is a concern for departments as well as citizens (Schrock, Susan 2012). Intelligent voice recognition technology may prove to not only to increase efficiency, but save agencies and taxpayers alike by reducing the number of associated accidents that result in death, injuries, loss of work time and significant monetary awards from law suits.

The explosion of voice recognition apps suggests that speech recognition has developed to the point that its applications will expand exponentially in the not so distant future (Pinola, Melanie, 2011). Adapting new and innovative technologies in law enforcement will increase performance, productivity, reduce costs and increase safety.

Some experts, such as Michael Dertouzos at MIT, argue that the Information Marketplace will not reach its full potential until the interaction between humans and machines become closer to human-to-human communication (Yale-New Haven Teachers Institute 2013). Of course, these advances all come with a cost.

Economics

Research and development projects like "Project 54" conducted by The University of New Hampshire, have developed a system utilizing non-proprietary interfaces and compatibility with the widest possible range of equipment (Stockton, Dale 2005). The federally funded project led to the creation of software used to operate a patrol vehicle's radio, lights and sirens via voice commands. The program also allows officers to speak license-plate numbers into MDT terminals, which provides audible information about the requested vehicle (Foreman, Kelly 2010).

The system requires interface boxes that control individual equipment which ties into the computer (which most police vehicle already possess) utilizing software and a microphone. The total cost depends on the type of equipment already installed in a car, market prices of the components and installation rates. Cost initially reported by the project engineers were less than $2000, in 2005 (Stockton, Dale 2005). COPS Technology Grants may be a source of funding for all or part of the associated costs of this technology (COPS, 2013). Obtaining funding resources presents a substantial barrier to technology innovation. Many government agencies operate with fairly lean or underfunded budgets. Most funding sources go toward personnel. There are state and federal agencies that provide funding for research, as well as new products. Departments

should take advantage of grants aimed at introducing new products and technology into the field. Smaller agencies can form committees of forward-thinking individuals to assess new technology with an eye on larger ones who have more resources to acquire, evaluate, and implement new technology. Committee members make recommendations to an agencies management that serves to guide the organization helping to alleviate reluctance in adapting a new technology (FBI 2008).

The Future of VRT in Patrol Cars

The question remains; how could Artificially Intelligent Voice Recognition have on law enforcement patrol operations in the next decade? Research has not yet revealed a clear answer to this question; thus, imagining how we might be able to extend on the capacity of SIRI, Nuance and others will have to suffice. Several variables can and will influence the extent of the continued use of VRT over the next ten years that are difficult to predict. There will need to be further research and study on cognitive load, relating to the amount of information and interactions one can process simultaneously, and how that affects human-computer interactions. Here are five key components used as a baseline for agencies to evaluate and assess a plan for implementation of VRT (Boswell, R. NGT 2012). The following are those identified:

- Identify and secure a funding source(s) to pay for the research, purchase and training required to implement this project.
- Work to ensure that the project is managed using the most cost efficient methods that assures resources are not wasted.
- Ensure policies and procedures are in place to enhance public safety.

- Use technical systems and software that is readily upgradable and adapted for expansion for future uses to maximize benefits.
- Ensure that all designated staff is fully trained and proficient in the uses of the technology.

The future of policing depends on the use of technology to enhance human ability. The integration of computer systems is essential to the law enforcement profession. Notwithstanding costs and legal constraints, officers may become even more efficient with the proper application of advanced technology (Boswell, R. NGT 2012).

Conclusion

Adapting new and innovative technologies in law enforcement will increase performance, productivity, reduce costs and increase safety (SEASKATE, Inc, 1998). Developing and implementing alternative methods of human machine interface like voice recognition, law enforcement can continue to adapt future technology as a means of not only becoming more efficient, but also one that is safer for society as a whole (Choate, Dave, 2010). Focus and awareness are at the heart of what emergency responders do. Imagine helping responders cut down on those distractions by integrating all systems traditionally separate in a police vehicle into a single interface activated by voice. Then imagine the lives that will be saved and careers that will not be cut short.

If we are successful and achieve increased human machine communications with the use of this technology, it will significantly decrease officer reliance on manual manipulation of in-car safety and communications equipment that distracts them. It could prevent accidents, which would result in fewer injuries, fewer lawsuits, and less liability.

These expectations include the appropriate expenditures of tax dollars for personnel and equipment that allow employees to do their job. To do this, an organization must seek out the newest technological advances that will provide the foundation for them to be efficient and effective.

The police-car environment may well be one of the most challenging aspects faced by today's law enforcement officer. The amount of technology an officer is tasked to control will only grow in sophistication and complexity stretching the physical abilities beyond normal boundaries. Voice recognition can improve the interaction between officers and the systems they are utilizing in the course of their duties. Of much greater importance is that it would also save lives, both that of the police and those they serve. That promise compels us to explore how VRT may be used in the patrol car of the future. Since VRT is already here in rudimentary form, the time is now.

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2. This figure is based on (a) NHTSA estimated cost of a fatal traffic collision 2000; (b) increase of 4.8% annual to adjust for 2009; (c) addition of PSOB amount (per officer); and (d) averaged for LEO fatalities 2004-2008.

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