THE VAN HORNE INSTITUTE

PANEL ON "AUTOMATED VEHICLES AND THE FUTURE OF WORK"

by

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My task today is to look at the subject of the future of work from 39,000 feet and to try and predict what jobs will and will not survive the coming of many disruptive technologies --- and what we all should be doing to prepare for the Brave New World, particularly that of automated vehicles (AVs). I believe that AVs will be nothing less than the first widely-available “autonomous robots” to be used by nearly everyone in the world's advanced economies. And AVs are not just on some drawing boards somewhere but are actually operating today, or are about to operate soon, on roads all over the world.

But before zeroing in on AVs, let me list some of the other disruptive technologies that will transform 21st century civilization beyond recognition. These technologies include: quantum computing, 3D printing, nanotechnology, financial blockchains, metadata mining, amazing new mobile phone technology, 3D scanning and power generated by fusion reactors, not today's fission ones.

Eric Brynjolfsson and Andrew McAfee, the MIT professors who last year wrote *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*, correctly, I believe, tell us that the world today is at an “inflection point” that heralds the dawn of a new age. In the 18th century, the Industrial Revolution ushered in the First Machine Age, the first time in human history during which progress was driven primarily by technological innovation, and the most profound time of transformation our world has ever seen. The Second Machine Age, which we are just entering, promises another equally profound change, one that will soon see tasks that are today routinely done by humans being done by computers.

I am a lawyer by trade. In my profession, many of my colleagues refuse to acknowledge that

> “...increasingly capable systems --- from telepresence to artificial intelligence --- will bring fundamental change in the way that the 'practical expertise' of specialists is made available in society.” *Richard Susskind and David Susskind, The Future of the Professions (2015).*

The Susskinds claim, correctly I believe, that the long, historic arrangement that, for centuries, has granted monopolies to various professions, like law, is “antiquated, opaque, and no longer affordable.” These monopolistic professions include, not only law, but medicine, teaching, accounting, architecture, the clergy, consultants and many others. Already, here in Ontario, several enterprising young law students at the

University of Toronto law school two years ago rented IBM's Watson computer and fed into it all of the corporate and tax law of Ontario. They then created algorithms that allows users of the system --- it's called ROSS, by the way --- to get answers to any commercial law questions that are put to it. Initially, of course, it is lawyers who will use it but, in due course, sophisticated commercial users or clients will want go directly to ROSS, without using a lawyer to help them. That is called disintermediation --- a process that has been happening in many areas of our lives for years: think of how many people now book their travel plans on line, or hotel rooms on airbnb or automobile transportation on Uber or Lyft.

As the new federal government prepares to lash out billions on infrastructure, it will be important for them, and all levels of government, to become aware of the impacts AVs will have on many projects. Indeed, with many expensive transit projects --- like building LRTs in Toronto and Calgary --- an “AV audit” or “AV impact study” should be done before large sums of money are committed to projects that will have 30-50 year “lives.” Why? Because AVs will dramatically influence transit projects of all kinds. An excellent recent paper, entitled *Driving Changes: Automated Vehicles in Toronto* by my fellow panellist, David Ticoll, reinforces this opinion by foreseeing a revolutionary --- and very disruptive --- change in how transit everywhere will look in a decade or two. The Hon. David Emerson, in his recent Canada Transportation Act Review report recommended “AV audits” in these situations. And my friends and colleagues at CAVCOE --- the Canadian Automated Vehicles Centre of Excellence --- last December issued a White Paper for the Government of Canada on the subject of *Preparing for Autonomous Vehicles in Canada*. Their paper is must reading for anyone interested in this subject.

The Economist recently told its readers that

> “...incumbent [automobile] manufacturers are recognizing the double threat posed by [AV] technology, as car-sharing takes off and driverless vehicles come closer. First, some people who might hitherto have wanted to own a car may no longer do so, cancelling out growth the motor industry might otherwise have expected from the rising middle classes in developing countries...Second, technology firms might be better placed than car makers to develop and profit from the software that will underpin both automated driving and vehicle-sharing. Some of these tech firms may

even manufacture cars on their own."

Google's famous self-driving cars have already logged more than a million miles on northern California highways, without an accident that was actually caused by the Google car. Google plans to hit the market with an electric, fully-automated, low-speed (40 kph) two-seater prototype vehicles. One hundred to 200 of these vehicles may be available in California this year, thanks in part to regulations allowing the operation of fully-autonomous vehicles that California introduced last year.

Ontario recently took some baby steps towards that same kind of regulation a few months ago. Under these regulations, Ontario requires a formal application from any company or organization that wishes to test AVs here and is offering a "carrot" in the form of a $3 million fund in matching grants to support AV research, development and commercialization. But other Canadian provinces are nowhere to be found in preparations for the introduction of AVs. As part of the massive infrastructure spending being planned by our new federal government, one trusts that Ottawa will spend some money on thinking about AVs and the profound impacts they will have on the Canadian transportation system.

Six US states --- California, Florida, Michigan, Nevada, North Dakota and Tennesssee --- plus the District of Columbia have legalized AV trials and another 20 states are looking seriously at AV regulations. The German Ministry of Transportation has, with the help of car manufacturers and supply chain participants, released a report on automated and connected-driving technologies. Highly automated vehicles are expected to hit the German market by 2020. At last week's AGM, Mercedes promised a battery-powered car with a 500-km range by the end of the decade. Last year, the British government issued a code of practice for AV testing --- which is currently happening in Milton Keynes in Buckinghamshire, near London. The UK is also trying to establish a British-based AV manufacturing industry. This year, Volvo is running a 100-car AV project in its headquarter city of Gothenburg. And the following countries have serious government-supported AV initiatives: Australia, China, France, Japan, Korea, the Netherlands and Singapore. Finally, President Barrack Obama recently announced a two billion dollar program to plan for national regulatory standards for AVs in the United States.

In Canada, the most significant class of automated vehicles are the large bitumen-carrying trucks that are owned and operated by Suncor in the Alberta oil sands.

I am told that fully one-third of Suncor's fleet is now automated and that the remainder of Suncor's fleet will be converted to autonomy in the coming year or two, thereby eliminating scores of well-paying jobs --- forever. For anyone driving a truck anywhere in Canada today, those Suncor trucks are the handwriting on the wall. And don't forget that automated combines have been operating in North America for a few years, ending the careers of those who hitherto were driving those machines.

Apple --- a company with about $180 billion in cash in its treasury --- is said to be planning to enter the competition to design and market AVs. If that happens, that will be a true game changer. One of the most significant things to know about AVs is that the Googles and Apples and the Teslas have quite different visions than conventional automobile manufacturers. In contrast to the software giants, the auto manufacturers are coming at the AV future in an evolutionary rather than a revolutionary way. They are gradually adding Advanced Driver Assistance Systems (ADASs) to familiar vehicle models, starting with the high-end ones. You can see some of these features on TV ads already as manufacturers add ADASs that prevent collisions, keep cars in lane, feature intelligent cruise controls and parallel park automatically.

By 2020, most major auto manufacturers will have vehicles in their showrooms that are capable of driving themselves for some of the time --- like airplanes on autopilot. By 2025, several manufacturers have indicated that they expect to have fully automated vehicles for sale. The Big Question is: will Google, Tesla and Apple cars squeeze the conventional automobile manufacturers out of the field? It is worth remembering that, of the thousands of wagon manufacturers that existed in North America at the end of the 19th century, only Studebaker made it as a car manufacturer. And where is Studebaker today?

So, which jobs will be either eliminated or critically impacted by the coming of AVs? Here is a partial list that Paul Godsmark, Barrie Kirk, Vijay Gill and I compiled for our paper on AVs that was published in January of 2015: transport, truck and courier service drivers (currently 560,000, or 1.5 per cent of the Canadian work force and made up mostly of men); taxi, limo drivers and chauffeurs (currently 50,000 in Canada); bus drivers; snow plow drivers; gas station employees; auto body repair people; auto insurance companies and salespeople; traffic police and traffic wardens; road safety professionals; tow truck drivers --- CAA-related and independent ones; driving instructors and trainers; trauma personnel at emergency rooms in hospitals; critical health care staff (e.g. physiotherapists) for accident victims; health care staff involved with organ and tissue donations; parking attendants (who have already mostly disappeared already); parking garage owners; lawyers, paralegals and assistants

representing people involved with collisions and the injuries resulting from them; and government employees in provinces with no-fault auto insurance programs that will disappear over time.

Some observers think the switch from conventional, human-driven vehicles to AVs will take decades. Looking at a similar time in history about a century ago it is worth noting that it took about a dozen years for New York to switch from horse power to horsepower. In 1900, 4192 cars were sold in the United States. By 1912, that number had risen to 365,000 --- coincidentally about the same number as Tesla 3 vehicles that have been sold in the last 10 days. In 1912, traffic counts in New York showed there were more cars than horses for the first time. Interestingly, freight haulage was the last bastion of horse-drawn transportation: the motorized truck finally supplanted the horse cart in the 1920s. I am old enough to remember horse-drawn milk, ice and fish wagons on the streets of the post-world war Halifax in which I grew up so horses took a long time to disappear in many places. And, no matter how completely the AV takes over driving in cities and on main highways, there will always be a market for people like sports car enthusiasts who will want to drive their Mgs, Triumphs and Miatas along country roads.

On the other side of the work “coin”, the world of AVs will bring new business and work opportunities for the auto and tech industries that are designing and manufacturing the software (and hardware) for AVs. The size of these opportunities will party depend on the extent to which federal and provincial government will stimulate activity in the AV space. In short, will the new jobs be created in Canada or will we buy the new technology the way we buy our iPhones --- from abroad? As I said earlier, many other countries are gearing up for this challenge but Canada, so far, is nowhere to be found on this technology turf. We should be paying better attention because most, if not all, AVs will be electric vehicles. Accordingly, it is safe to predict that the overall consumption of petroleum used for powering vehicles of all kind will fall. Plus the need for more electric generation will grow. One canary in the coal mine is to be found in Quebec where many large truck fleets are switching from diesel to natural gas to power them. Indeed, along a major highway from Quebec City to Montreal, stations already exist to fuel trucks with natural gas. Who will build and own the charging stations needed for AVs? Indeed, who will own the AVs?