Posted on 17 Apr 2023 — The copyright holder is the author/funder. All rights reserved. No reuse without permission. — https://doi.org/10.15200/winn.145536.66997 — This a preprint and has not been peer reviewed. Data may be preliminary.

Science AMA Series: We study how intelligent machines can help us (think of a car that could park itself after dropping you off) while at the same time they threaten to radically disrupt our economic l

Intelligent$_{M}achines^{1}andr/ScienceAMAs^{1}$

[1]Affiliation not available

April 17, 2023

Abstract

Hi Reddit! We are computer scientists and ethicists who are examining the societal, ethical, and labor market implications of increasing automation due to artificial intelligence. Autonomous robots, self-driving cars, drones, and facial recognition devices already are affecting people's careers, ambitions, privacy, and experiences. With machines becoming more intelligent, many people question whether the world is ethically prepared for the change. Extreme risks such as killer robots are a concern, but even more so are the issues around fitting autonomous systems into our society. We're seeing an impact from artificial intelligence on the labor market. You hear about the Google Car—there are millions of people who make a living from driving like bus drivers and taxi drivers. What kind of jobs are going to replace them? This AMA is facilitated by the American Association for the Advancement of Science (AAAS) as part of their Annual Meeting Bart Selman, professor of computer science, Cornell University, Ithaca, N.Y. The Future of AI: Reaping the Benefits While Avoiding Pitfalls Moshe Vardi, director of the Ken Kennedy Institute for Information Technology, Rice University, Houston, Texas Smart Robots and Their Impact on Employment Wendell Wallach, ethicist, Yale University's Interdisciplinary Center for Bioethics, New Haven, Conn. Robot Morals and Human Ethics We'll be back at 12 pm EST (9 am PST, 5 pm UTC) to answer your questions, ask us anything!

the WINNOWER

REDDIT

Science AMA Series: We study how intelligent machines can help us (think of a car that could park itself after dropping you off) while at the same time they threaten to radically disrupt our economic l

INTELLIGENT_MACHINES R/SCIENCE

Hi Reddit!
We are computer scientists and ethicists who are examining the societal, ethical, and labor market implications of increasing automation due to artificial intelligence.
Autonomous robots, self-driving cars, drones, and facial recognition devices already are affecting people's careers, ambitions, privacy, and experiences. With machines becoming more intelligent, many people question whether the world is ethically prepared for the change. Extreme risks such as killer robots are a concern, but even more so are the issues around fitting autonomous systems into our society.
We're seeing an impact from artificial intelligence on the labor market. You hear about the Google Car—there are millions of people who make a living from driving like bus drivers and taxi drivers. What kind of jobs are going to replace them?
This AMA is facilitated by the American Association for the Advancement of Science (AAAS) as part of their Annual Meeting
Bart Selman, professor of computer science, Cornell University, Ithaca, N.Y.The Future of AI: Reaping the Benefits While Avoiding Pitfalls
Moshe Vardi, director of the Ken Kennedy Institute for Information Technology, Rice University, Houston, TexasSmart Robots and Their Impact on Employment
Wendell Wallach, ethicist, Yale University's Interdisciplinary Center for Bioethics, New Haven, Conn. Robot Morals and Human Ethics
We'll be back at 12 pm EST (9 am PST, 5 pm UTC) to answer your questions, ask us anything!

READ REVIEWS

WRITE A REVIEW

CORRESPONDENCE:

DATE RECEIVED:
February 14, 2016

DOI:
10.15200/winn.145536.66997

ARCHIVED:
February 13, 2016

CITATION:
Intelligent_Machines , r/Science , Science AMA Series: We study how intelligent machines can help us (think of a car that could park itself after dropping you

Do you think it's likely that human-driven cars will eventually be banned from non-specialised (e.g. Sporting) use, due to the relatively fallible and inefficient nature of human drivers?

What sort of effects would we likely see autonomous drones, robots and cars have in poorer, developing regions of the world?

How would an autonomous AI likely handle a Trolley Problem? Who would likely decide on an AI's behaviour in such a scenario?

TheFlyingEgg

(Bart:) It's quite likely that human-drivers will be banned from general roads at some point in the future. This will make those roads safer for everyone. (Moshe noted that horses are already banned from most public roads. So, transportation does evolve.)

Autonomous drones can be of great benefit in agriculture and other endeavors in the developing world.

off) while at the same time they threaten to radically disrupt our economic l, *The Winnower* 3:e145536.66997 , 2016 , DOI: 10.15200/winn.145536.66997

© et al. This article is distributed under the terms of the Creative Commons Attribution 4.0 International License, which permits unrestricted use, distribution, and redistribution in any medium, provided that the original author and source are credited.

The trolley problem is being addressed in the self-driving car setting. Not yet in the extreme form it is usually presented but on a smaller but more common scale. For example, a self-driving car may move slightly outside of its lane to get a better view of the traffic ahead. There is a gain of information from this action at the cost of a slight increase in risk. Decision theoretic models can make a cost-benefit calculation to decide on the optimal action to take. I expect more advanced decision models will deal more directly with the Trolley problem. (Note that humans don't do so well on the trolley problem in accident scenarios.)

Do you think it's likely that human-driven cars will eventually be banned from non-specialised (e.g. Sporting) use, due to the relatively fallible and inefficient nature of human drivers?

What sort of effects would we likely see autonomous drones, robots and cars have in poorer, developing regions of the world?

How would an autonomous AI likely handle a Trolley Problem? Who would likely decide on an AI's behaviour in such a scenario?

TheFlyingEgg

MYV: You cannot ride horse in downtown Houston anymore. If you like horse riding, you have to go to horse ranches. The same is likely to happen with cars. I expect human driving to become illegal in the next 25-35 years in developed countries. Deployment in developing countries will be slower. It is a matter of cost arbitrage. And yes, machine ethics is now starting to become an important in AI research.

Do you think it's likely that human-driven cars will eventually be banned from non-specialised (e.g. Sporting) use, due to the relatively fallible and inefficient nature of human drivers?

What sort of effects would we likely see autonomous drones, robots and cars have in poorer, developing regions of the world?

How would an autonomous AI likely handle a Trolley Problem? Who would likely decide on an AI's behaviour in such a scenario?

TheFlyingEgg

WW: There will certainly be proposals for this if self-driving cars turn out to be much safer, as expected. But in the U.S. this will be a revolutionary proposal that will create more tension than present policies to restrict the acquisition of guns.

I've been working my way through Roman history, and I've noticed an interesting parallel:

As the republic became more successful, specifically around the time Carthage was destroyed, its economy was battered by an influx of free labor---slaves. These slaves replaced the middle class farmers who had been the backbone of the republic and the army. What Nobel would pay a freeman for what he could get for free?

The middle class migrated to big cities in search of work, and found poverty. The Roman government had two solutions:

1. Bread and circuses. Welfare on a massive scale.
2. Professionalize the standing army. . . Which only accelerated the process by bringing in more

slaves through conquest.
Both of these had their hand in the downfall of the republic---discontented citizens + large standing army = civil war.

What solutions do you see out of this bind?

MirthMannor

MYV: This is going to be my final answer on this AMA.

The reason we are raising these issues now is to raise public awareness of them. We need to make technological unemployment an important policy issue, analogous, say, to the climate-change issue. We need to start thinking NOW about how to restructure our economic life. If we wait 25 years, then the market may lead us to a Roman-like reality. Technological unemployment deserves to be one of the most major public-policy issue that we grapple with, but we are in an election year and this issue is simply not on the radar screen. This MUST change.

What will autonomous cars do to the insurance industry? If I buy a car that is supposed to drive itself, I shouldn't be responsible for any accidents it may get into? Shouldn't the auto manufacturer insure the car?
Assuming that will be the case, we have to assume there will be times when the owner takes control. Does this mean that there will be a two tiered insurance system for two different coverages?

lizardflix

(Bart:) Great question. Self-driving cars will lead to dramatically fewer accidents (factor 10). This will shrink the market for the car insurance industry. Who is responsible for any remaining accidents is a great question. We are already seeing car companies (Volvo and Tesla) considering picking up the cost of any accidents caused by their cars. As long as the cars can be made safe enough, this will be cost effective. (Note that 90% of current accidents are due to human error.) Self-driving cars will stay alert 100% of the time and can look around them 360 degrees in real-time about 50 to 100 meters out.

What will autonomous cars do to the insurance industry? If I buy a car that is supposed to drive itself, I shouldn't be responsible for any accidents it may get into? Shouldn't the auto manufacturer insure the car?
Assuming that will be the case, we have to assume there will be times when the owner takes control. Does this mean that there will be a two tiered insurance system for two different coverages?

lizardflix

MYV: The automation of driving is likely to reduce accident rates dramatically, reducing life, limb, and property damage. Car manufacturers will have to assume responsibility for accidents caused by machine malfunction. The car insurance business will shrivel away. Lawyers and hospitals will also lose the very significant income they receive now from the car-accident business.

What will autonomous cars do to the insurance industry? If I buy a car that is supposed to drive itself, I shouldn't be responsible for any accidents it may get into? Shouldn't the auto manufacturer insure the car?
Assuming that will be the case, we have to assume there will be times when the owner takes control. Does this mean that there will be a two tiered insurance system for two different coverages?

lizardflix

WW: Some manufacturers of self-driving cars appear ready to take on the liability, but they will probably offload it on willing insurance companies, or there may be no-fault for self-driving, but in one form or another consumers will end up paying for the costs. Perhaps we can charge companies differently depending upon the safety record of their automobiles.

During the time I have owned my nas, my router, and my PC there have been about dozen documented takeover exploits or backdoors documented on them, and often the company pretended like they didn't exist for some time. How do you reconcile these types of technological flaws are introduced into machines that could kill me, or others?

differencemachine

Moshe Vardi (MYV): Cybersecurity has emerged as a top challenge for information technology. Not a week passes by without news of some major computer break-in. We do not have network security, we have network insecurity. Clearly, we cannot deploy the Internet-of-Things without some major improvement in computer security.

Do you folks ever utilize science fiction to help you generate concepts and ideas? The genre contains a lot of very intelligent people speculating on possible directions that technology will take in the future, and how those changes will affect society. It seems like it could be a helpful resource.

Snatch_Pastry

MYV: Asimov's Caves of Steel in essence was about the "robots and jobs" problem. The solution advocated by the end of the book is for humans to migrate to other planets. Today it is hard to take such a solution seriously.

Do you folks ever utilize science fiction to help you generate concepts and ideas? The genre contains a lot of very intelligent people speculating on possible directions that technology will take in the future, and how those changes will affect society. It seems like it could be a helpful resource.

Snatch_Pastry

WW: Yes, I do. Often Scifi writers are just social theorists thinking possibilities and options will ahead of scholars.

Do you think that the economic consequences of automation will result in a better quality of life for the lower class?

Will this result in a similar situation as the Industrial Revolution i.e. poor unskilled workers being forced into a new role in society, population shifts and lessening in quality of life; or will this be less dramatic or even positive for the lower class?

captainthirsty

MYV: For the first 100 years of the Industrial Revolution, the lower classes suffered significantly. We have data on shorter life expectancy, for example. In a sense, full adjustment to the Industrial Revolution came only around 1990s, with the end of Communism as a political system. The coming Automation Revolution will unfold much faster than the Industrial Revolution, and we will have to adjust much faster.

Do you think that the economic consequences of automation will result in a better quality of life for the lower class?

Will this result in a similar situation as the Industrial Revolution i.e. poor unskilled workers being forced into a new role in society, population shifts and lessening in quality of life; or will this be less dramatic or even positive for the lower class?

captainthirsty

WW: Yes but only if we make the political and economic reforms that allow people to meet their needs and to some degree their desires.

Do you have a ballpark estimate for how long until automation becomes the most important topic for the economy at large? How long until it's a core issue that governments have to step in and do something about it?

Quadratic-

MYV: The hardest thing to predict about technology is the speed of its progress. We tend to underestimate the difficult of solving technical problems, for example, chess playing. At the same time, we tend to underestimate the profoundness of the change caused by new technology. Imagine trying to predict in 1900 the change to be unleashed by automobiles and planes. Nevertheless, based on past progress, I'd view the next 25-50 years as pivotal.

Do you have a ballpark estimate for how long until automation becomes the most important topic for the economy at large? How long until it's a core issue that governments have to step in and do something about it?

Quadratic-

MYV: Take a look at the data here: http://www.cs.rice.edu/~vardi/papers/aaai15-tutorial.pdf According to data compiled by BrynJolfsson and McAffee, since 1980 we have seen a divergence between productivity and GDP growth, on one hand, and job creation and family income on the other hand. They call this, "The Great Decoupling," and believe that technology is a major driver. Thus, automation is already a major issue today, except that it is yet to be recognized so by the public, and therefor, by policy makers.

Do you have a ballpark estimate for how long until automation becomes the most important topic for the economy at large? How long until it's a core issue that governments have to step in and do something about it?

Quadratic-

WW: It is already a problem, but submerged beneath political and economic issues that often function as distractions. The topic could still erupt in this presidential cycle as an explanation for some of the political disaffection. But I would guess two to three years before it emerges more fully.

Do you have a ballpark estimate for how long until automation becomes the most important topic for the economy at large? How long until it's a core issue that governments have to step in and do

something about it?

Quadratic-

(Bart:) Changes will be gradual but within 10 years we will see major effects. It would be good for governments to start paying attention already.

Most people were probably made aware of this complex issue from CGP Grey's videoHumans Need Not Apply. Does that video do a good job covering the basics? Anything it gets wrong (in your opinion) or should be elaborated on?

mentos_mentat

MYV: Grey does a very good job of introducing the issue in 15 minutes. For a longer introduction to the issue of Technological Unemployment, see http://www.cs.rice.edu/~vardi/papers/aaai15-tutorial.pdf.

Hi. Do you think capitalism is sustainable in the long run?

I'm thinking that when at some point there aren't any jobs left (or very few) people will have no buying power which means no revenue for businesses. We would have to completely rethink society; if people don't have money they can't survive. The idea of a monetary system would no longer make sense unless we simply give everybody money for doing nothing.

I also believe that the people in power (i.e. the few % that are extremely rich) would fight very hard to keep capitalism going since it would sustain their wealth. So basically we'd run into a period where half the world population (or more) are starving due to lack of income while the rich refuse to remodel society.

So all I'm saying is: shit is going to hit the fan hard. As in a major world war where everyone will be fighting for the resources that will still cost money but shouldn't.

What are your thought on this?

MyRoomAteMyRoomMate

MYV: In the 1990s, there was those who thought that we have reached "The End of History". Today we understand the naivety of this view. Capitalism emerged together with the Industrial Revolution and has changed a lot over the past 100 years, responding to economic and societal pressures. Capitalism, of course, will have to continue to evolve. Whether we will still call it "Capitalism" in 100 years remains to be seen.

Thank you for this AMA. When discussing future automation, people like to compare the likelihood of particular jobs/careers being replaced. Anecdotally, it seems like many are convinced that the human role in *their* job or profession can't be easily superseded. As a secondary school teacher, I am surrounded by this mentality.

My question: which jobs, careers, or specific human activities do you believe are likely to be replaced by automation that would surprise people the most?

MutunusTutunus

(Bart:) Medical diagnosis. We are starting to see the first areas of medicine where diagnosis engines trained on tens of thousands of test cases are starting to display "super-human" performance (or at

least match the performance of the best human doctor). The human interaction in a medical setting will remain important but people may start to ask for a "machine opinion" in the near future.

Thank you for this AMA. When discussing future automation, people like to compare the likelihood of particular jobs/careers being replaced. Anecdotally, it seems like many are convinced that the human role in *their* job or profession can't be easily superseded. As a secondary school teacher, I am surrounded by this mentality.

My question: which jobs, careers, or specific human activities do you believe are likely to be replaced by automation that would surprise people the most?

MutunusTutunus

MYV: Jobs that require extensive human interaction are less likely to be automated. But our expectations as what jobs require extensive human interaction my change. Anyone wants to bet AGAINST sex robots?

What jobs are at most risk of being replaced by robots? The least?

Bigswole92

MYV: Technology eats jobs from the inside out. Jobs that require high cognitive and social skills (say, litigation attorneys) are not threatened yet, as well as jobs that require physical dexterity and situational awareness (say, restaurant table-clearing). Routinized clerical jobs are going away :-(

What jobs are at most risk of being replaced by robots? The least?

Bigswole92

MYV: Manufacturing jobs have already been replaced by robots. Manufacturing employment is below its 1950's level, while manufacturing volume (in constant dollars) is the highest it has ever been. Ports are almost completely automated. Now that Amazon is in the logistics business, I'd expect it to push hard to fully automate logistics.

What jobs are at most risk of being replaced by robots? The least?

Bigswole92

(Bart:) Jobs "in the middle." Highly creative professions will take longer to automate. Similarly, for some time, it will not be cost effective to automate low level manual jobs in *unstructured* environments. However, jobs that require medium skills and knowledge will be most at risk.

What jobs are at most risk of being replaced by robots? The least?

Bigswole92

WW: All jobs that perform repetitive activities, even high-end tasks such as legal research can be replaced. Jobs that require many skills will be harder to replace.

As a cyclist, I'm concerned with how we fit into a world of self-driving cars. Will we be at risk? Will we be causing traffic jams? Will we be banned from roads altogether?

fernguts

(Bart:) I believe self-driving cars will be great for cyclists. One way to view a self-driving car is as the "ultimate obstacle avoiding" vehicle (360 degree real-time view; 50 to 100 meters around). So, cyclists will be detected and kept track of by the cars and cars will make sure not to hit them.

I'm a firm believer that one day with automation and artificial intelligence we will move beyond the idea of working, making a living, and money in general. Do you see this potentially down the road yourselves?

hepdepdep

WW: Yes, but only if we solve the political and economic problems of ensuring that people have the goods and service they need to support themselves.

I'm a firm believer that one day with automation and artificial intelligence we will move beyond the idea of working, making a living, and money in general. Do you see this potentially down the road yourselves?

hepdepdep

MYV: Yes, we may be facing the "end of work", or at least "the end of work as the fundamental activity of adult humans between the ages of 25 and 65". What will humans do if machines can do almost any human job may be one of the most profound questions that humanity ever faced.

I'm a firm believer that one day with automation and artificial intelligence we will move beyond the idea of working, making a living, and money in general. Do you see this potentially down the road yourselves?

hepdepdep

(Bart:) I do see potential for this but a key issue is how society will prepare itself to make his beneficial for everyone. Note that currently work provides many of us with a purpose in life.

Do you see Universal Basic Income as being a needed element to maintain stability in an economy impacted by these new technologies? If not, why? If so, do you think it is practical?

Citrik

WW: This will have to be my last answer. Probably necessary, and already being implemented in some European countries. But it would be very difficult to implement in the U.S. If there are truly productivity gains from automation it is practical, although it would probably mean heavy taxation on the owners of production, those of us who own stock.

Do you see Universal Basic Income as being a needed element to maintain stability in an economy impacted by these new technologies? If not, why? If so, do you think it is practical?

Citrik

I think it will be practical. We'll know more soon because there are a few places in Europe that are starting to experiment with a Universal Basic income. One concern I have is whether people will feel fulfilled without having some kind of job for most of their life. It's an open question.

I read a piece from Planet Money (I think) about how all through industrial history, technological advancements were touted as "ending human labour as we know it." The general thrust of the piece was that every time something transformative came along, a lot of jobs and economic sectors may have been affected and jobs lost, but the economy at large merely shifted to create jobs in other areas that were previously nonexistent.

Will this scale of automation "end work as we know it," or will we see a huge amount of jobs created in other sectors of the economy as a result of this change?

SorcerorDealmaker

(Bart:) Great question. The industrial revolution brought us machines that were much stronger or faster than humans. We adapted and shifted to more "intellectual / knowledge-based" work. (Aside: the transition was not so smooth as most folks think. It took several decades.) We're now at a unique point in human history, where machines are starting to replicate (and surpass) our intellectual capabilities. It is not clear that there is another uniquely human capability we could switch to in terms of work.

Would A.I. Intelligence be viable for jobs like truckers and bus drivers if the majority of drivers on the road are real people? I know the google car has logged hundreds of thousands of miles with only human fault being the cause of accidents, but with cargo and human lives on board, it seems like an insane risk. Seems like it'd be a huge liability with people looking to cash in on insurance payouts or possibly steal cargo on some isolated stretch of interstate.

chickensoddlenoup

WW:People trying to game robotic vehicles for personal gain, will certainly be an issue.

Would A.I. Intelligence be viable for jobs like truckers and bus drivers if the majority of drivers on the road are real people? I know the google car has logged hundreds of thousands of miles with only human fault being the cause of accidents, but with cargo and human lives on board, it seems like an insane risk. Seems like it'd be a huge liability with people looking to cash in on insurance payouts or possibly steal cargo on some isolated stretch of interstate.

chickensoddlenoup

MYV: Machines and people do not mix well together; machines can adapt, but people are slower to adapt. Most of the accidents involving the Google car involve human drivers. Finding ways to separate humans and machines is one of the challenges between today and the driver-less future.

Would A.I. Intelligence be viable for jobs like truckers and bus drivers if the majority of drivers on the road are real people? I know the google car has logged hundreds of thousands of miles with only human fault being the cause of accidents, but with cargo and human lives on board, it seems like an insane risk. Seems like it'd be a huge liability with people looking to cash in on insurance payouts or possibly steal cargo on some isolated stretch of interstate.

chickensoddlenoup

It seems reasonable to assume that such truck would be monitored remotely 24/7 in real-time. Computer vision programs could look for unusual behaviors and risks.

First off, thank you all engaging the masses with this AMA.

I work in two fields that my questions for center around: tech support and shipping for a large food production company. In each of these fields I can see eventual full autonomisation but I'm curious as to the following: How close are we to bring able to fully and acceptably functionally "upgrading" to full autonomisation of these fields? I see the by-phone tech support being much closer to this point, as it would seemingly require much less hardware and logistical work. I would also like to add that as far as autonomisation of tech support to me would mean there would actually be am AI actually speaking to the caller as opposed to the current "press X for Y problem' systems in use today.

As far as shipping or really just general warehouse work, this business sector seems like it'd be " safe" in terms of job security for much longer as there are just so many more factors and variables to balance in that setting.

Also do we have any high-functioning, fully autonomous factories currently? Lastly, once these fields because autonomous, would it be a safe bet that many of whom would be out of a job at that point would be able to migrate professionally to being maintenance technicians for the new systems?

Again thank you so much for this exciting AMA, I look forward to seeing your responses!

EDIT: As experts in your fields do you think universal basic income is a good path to aim for as autonomy becomes more commonplace? If not what would you consider to be a better program or process to proceed, societally speaking?

Kthonic

(Bart: this will be our last question): For now, it appears that warehouse automation (e.g. Kiva robotics systems, bought by Amazon) reduces the need for human labor but will not eliminate it. Also, these systems are still quite expensive and are only used by rather large companies for now.

Automated tech support will improve significantly over the next few years. Speech recognition has improved significantly, thanks to deep learning. It's still continuing to improve. Also, researchers are working hard to create better true dialog systems for much more natural interactions.

Computer chip manufacturing represents currently the most highly automated factories. There are billion dollar plants monitored by just a few human workers.

Universal basic income is definitely a direction worth considering.

First off, thank you all engaging the masses with this AMA.

I work in two fields that my questions for center around: tech support and shipping for a large food production company. In each of these fields I can see eventual full autonomisation but I'm curious as to the following: How close are we to bring able to fully and acceptably functionally "upgrading" to full autonomisation of these fields? I see the by-phone tech support being much closer to this point, as it would seemingly require much less hardware and logistical work. I would also like to add that as far as autonomisation of tech support to me would mean there would actually be am AI actually speaking to the caller as opposed to the current "press X for Y problem' systems in use today.

As far as shipping or really just general warehouse work, this business sector seems like it'd be " safe" in terms of job security for much longer as there are just so many more factors and variables to balance in that setting.

Also do we have any high-functioning, fully autonomous factories currently? Lastly, once these fields because autonomous, would it be a safe bet that many of whom would be out of a job at that point would be able to migrate professionally to being maintenance technicians for the new systems?

Again thank you so much for this exciting AMA, I look forward to seeing your responses!

EDIT: As experts in your fields do you think universal basic income is a good path to aim for as autonomy becomes more commonplace? If not what would you consider to be a better program or process to proceed, societally speaking?

Kthonic

MYV: Containerization has been a huge driver of globalization in the 20th Century. We have yet to see the full benefit of this, but in the foreseeable future ports will be complete automated. We can expect logistics to go down the same path. Packing a home may still take humans for quite a few years, but the economic imperative of automating logistics is unstoppable.

Discussions have started on adjusting our economic system to the onslaught of automation. BIG (Basic Income Guarantee) is the only serious proposal on the table right now. Certain European countries are starting to discuss it seriously.

I make my living harvesting grain with a scythe.

My neighbors have recently been experimenting with something they call a "plow" which they are even using oxen to pull.

I am concerned for my economic future. How can you reassure me that the government will protect my right to make a living?

yes_its_him

(Bart:) Part of the reason we are having these discussions is to try to involve a much broader audience. In the end, policy makers will need to get involved to ensure a good outcome for everyone.

Do you see self-driving vehicles causing a shift from private car ownership to more rentals like uber/zipcar? Will it improve public transposition to the point where my local bus system will actually be fast and reliable enough to use?

Basically, are we going to own cars in the future, or just rent them from Google when we need one?

jhg2v

Self-driving cars are indeed a natural fit for the uber/zipcar model. It will lead to a much more efficient use of resources.

Hi there! I've always been fascinated (and excited) about the automaton of transportation (I'm a pilot). A very real question: what do you think the ratio of human beings left in that occupation will be once the automation is "complete" ie. How many people doing their job now so you think will no longer be required (I'm assuming you still need a few to monitor or consult)?

lito_onion

MYV: You can look at modern factory floors to get an idea. You see huge production floors with almost no human in sight. Or look at Amazon's data centers, where wages account to 5% of their expenditures.

Hi there! I've always been fascinated (and excited) about the automaton of transportation (I'm a pilot). A very real question: what do you think the ratio of human beings left in that occupation will be once the automation is "complete" ie. How many people doing their job now so you think will no longer be required (I'm assuming you still need a few to monitor or consult)?

lito_onion

(Bart:) I would estimate about 10% human input remains needed.

Do you think self-operating machines will be able to communicate with each other? For example, two 18 wheelers get to an intersection without a traffic signal. In the human world, we give each other a nod or a wave to give right of way - sometimes. Can self driving vehicles do this?

Likewise, what happens with accidents a human operated car cuts off a self driving car for example, how will the self driving car know whether to hit the other car, swerve into another lane, run over a dog or smash into a school bus. Humans make these split second decisions.

VideoCT

WW: Autonomous vehicles communicating with each other is likely to be a 3rd stage in development. This, for example, would enable traffic adjustments and even platooning to speed up travel. But it would be hard to implement when most drivers are human.

Do you think self-operating machines will be able to communicate with each other? For example, two 18 wheelers get to an intersection without a traffic signal. In the human world, we give each other a nod or a wave to give right of way - sometimes. Can self driving vehicles do this?

Likewise, what happens with accidents a human operated car cuts off a self driving car for example, how will the self driving car know whether to hit the other car, swerve into another lane, run over a dog or smash into a school bus. Humans make these split second decisions.

VideoCT

MYV: The driver-less cars will communicate with each other, with the traffic lights, and with the road itself!

Even if there are self driving trucks, buses, and airplanes, wouldn't people still need to be employed to monitor and as a backup in case these systems fail?

DarthRoacho

WW: A lot of different questions here. Some warehouse work is already being roboticized, particularly carrying boxes, which employees millions worldwide. Work like this should be roboticized. Most commentators on technological unemployment do believe universal basic income is the way to go, but this begs how it might be implemented.