

## The Future of Work at the Human-Technology Frontier A UIDP Listening Session Summary

October 1, 2019

9:00 a.m. – 5:00 p.m.

Institute for Smart, Secure and Connected Systems (ISSACS)  
Case Western Reserve University (CWRU)

## Introduction

The Institute for Smart, Secure and Connected Systems (ISSACS) at Case Western Reserve University (CWRU) and the University Industry Demonstration Partnership (UIDP) co-hosted a workshop (“listening session”) to discuss University-Industry Collaborations and the Future of Work at the Human-Technology Frontier (FW-HTF) on October 1, 2019. This was the second in a series of listening sessions facilitated by UIDP, with sponsorship from NSF. It included a mix of plenary talks, a panel, short presentations, breakout sessions, and networking time.

Participants evaluated research and commercialization opportunities associated with building human-technology partnerships and augmenting human performance. Two FW-HTF themes were the focus for this listening session:

- **Augmenting Human Performance**
- **Illuminating the Socio-Technological Landscape**

This report attempts to present a summary of ideas and conclusions exchanged during the workshop. The comments and viewpoints discussed during the breakout sessions, reported out to the plenary at large, and captured in this report are not attributed to any one individual and should not be viewed as a group consensus or as a formal group recommendation.

### Companies approach the Future of Work from three perspectives



Source: McKinsey & Company 2019

# Meeting Summary

Provost Ben Vinson III, Case Western Reserve University welcomed guests, speakers and attendees. He urged the group to use the listening session as an opportunity to examine how CWRU and industries can partner to identify and advance research topics within the Future of Work space, where collaborations will yield the most impactful results.

This was followed by an overview of UIDP and the Listening Sessions by **Dr. Anthony Boccanfuso**, President, UIDP.

## University-Industry Panel

Next, **Anne Borchert**, Assistant Vice President, Corporate Relations and Strategic Projects, CWRU moderated a panel discussion on University-Industry Collaboration in the context of the Future of Work. Panelists included:

- **Maia Hansen**, Senior Partner, Cleveland, McKinsey & Company
- **Ronald L. Hickman Jr.**, Associate Professor and Associate Dean for Research, Center for Research and Scholarship, Frances Payne Bolton School of Nursing Case Western Reserve University
- **John Paul Stephens**, Associate Professor, Organizational Behavior, Weatherhead School of Business, Case Western Reserve University
- **Juergen Weinhofer**, Vice President, Common Architecture & Technology, Rockwell Automation

### Key Takeaways from the Panel Discussion

- Jobs will not go away, but they will change; by 2030, 30-40% of workers in developed countries will need to be reskilled and/or change their occupations
- Socio-emotional and higher cognitive skills, together with technological training, are the “skills of the future”
  - As shifts in specific skills accelerate, adaptability will be the most critical skill of all – being agile
- Skill shifts required vary by sector, though all industries will value meta-skills like continuous learning, comfort with change, and self-direction
- Technologies such as low-weight AR glasses (<100g) will help to change the physical nature of manufacturing
- Virtual work will free humans from the constraints of a physical workplace, which can profit employers by reducing facility costs and benefit employees by mitigating workplace hazards.
- AI/ML and automation will impact nursing, but the human touch will remain critical to healthcare
- Humankind will not become superfluous; rather, they will focus more fully on tasks which cannot be automated. Keeping humans at the center of everything we do will be critical to the successful adoption of current and future technological innovations.



# Theme 1: Setting Stage - Augmenting Human Performance

Following the panel discussion, **Kenneth A. Loparo**, Professor ECSE and Faculty Director of ISSACS, CWRU, introduced the topics and speakers for the first workshop theme, Augmenting Human Performance.

Theme 1 Breakout Session Topics	Speaker
The Role of Brain-Interfacing in Shaping the Future of Work	Abidemi Ajiboye
Impact of Robotics, Automation, and Intelligent Assistance Technologies on the Future of Work	M. Cenk Cavusoglu
The Future of Learning: How We Train Workers and Use Technology	Erin Henninger
NeuroReality and The Future of Work – Mind Transcending the Barriers of Body to Achieve the Full Human Potential	Dustin Tyler

Theme 1 Setting Stage session was followed by a working lunch featuring a talk on “Progress in Technology Research That Drives the Future of Work,” by **Brad Fenwick**, Senior VP for Global Strategic Alliances, Elsevier.

After lunch, audience members attended their choice of 1 of 4 breakout sessions based on the Theme 1 presentations. Each session, facilitated by one of the Theme 1 speakers, was a deep dive into opportunities, challenges, trends and key takeaways associated with that topic.

## Theme 1 – Summary of Breakout Sessions

Key takeaways from each breakout session were reported out to the reconvened plenary session, and are summarized below.

### ***The Role of Brain-Interfacing in Shaping the Future of Work***

#### **Abidemi Ajiboye**

Participants in this breakout session considered implications around human augmentation such as:

- Ethics around augmentation of human performance and perception
- How to make access to the technology equitable
- Security and privacy concerns with monitoring of neural data for non-medical applications (e.g., a person’s emotional state being used in job interviews)
- Ownership of a person’s brain data
- Impacts of data quality and accuracy; implications of data corruption & biases
- The implications for human relationships
- Benefits of a tech+ approach, especially from a regulatory standpoint

#### **Key Takeaways**

- Researchers, scientists and technologists (academia) need training in the dissemination of the implications/applications of their work to wider audiences (communities, general population)
- Community voice and concerns need to be heard and considered
  - Conduct town-gown events focused on building relationships between the university and its surrounding communities
- Address structural deterrents to team collaboration by requiring / rewarding interdisciplinary approach to research (and regulation?)
  - Biases in Team Science need to be addressed
  - Measures need to be put in place to address access issues and ensure equal access for all
  - Liabilities in modifying human capacity need to be addressed
- Pushing thoughts and ideas within safety net (consider collective good)

- Consideration for Intention vs. Outcome(s)
- Companies must balance the economic advantages to be gained from technology vs. worker autonomy
  - Labor unions and employee power that relies on equitable working environment
  - Capitalism—profits vs. people
- Emphasize transparency around the good and bad outcomes of augmentation
- Advent of artificial intelligence equates to symbiotic relationships
  - Profitability vs. workplace culture/worker satisfaction
  - Perception that Big Data is replacing human functions/job satisfaction
  - A.I. is just a technology that still requires human supervision to use; behavioral control is still in the human domain

## ***Impact of Robotics, Automation, and Intelligent Assistance Technologies on the Future of Work***

### **M. Cenk Cavusoglu**

This session explored advances in robotics and artificial intelligence technologies and pervasive intelligent and autonomous systems in the context of the future of work.

- Promises: Creation of New Industries and Occupations; Enhanced Productivity and Quality of Work Life; Potential for More People to Participate in the Workforce
- Potential Challenges and Impact: Jobs Lost to Automation; Mismatch between Worker Skills and Skills Required in New Industries; Security Threats; Algorithmic Biases; Dependence on Technology and Resulting Erosion of Human Knowledge and Skills

### **Key Takeaways**

- **Desired Outcomes:**
  - A policy where individuals affected benefit from their replacement automation
  - A cultural shift to recognize this shift in benefit
  - A study on the improvement in quality in education with modern education approaches; match education with needs (start vs. continue education)
- **Actionable Steps:**
  - Retrain human workers to collaborate with AI instead of perpetuating a climate of fear
  - Determine metrics on what should be automated

## ***The Future of Learning: How We Train Workers and Use Technology***

### **Erin Henninger**

This session explored ideas, drivers and risks of improving human learning and workplace performance through the use of technology, especially augmented and virtual reality (AR/VR); combinations of technology like environmental sensors, wearables and haptic gloves will alter how workers of the future learn, perform and interact— in ways that rapidly promote novice to expert and create workflow efficiencies.

### **Key Takeaways**

- Mixed reality is an opportunity to collaborate on large scale; influence policy makers
  - HoloLens brings data visualization to an understandable/relatable level
  - Must consider how to engage others—make Augmented Reality (AR), Virtual Reality (VR), Mixed Reality technology accessible to all. Start with designs for applications that make it easy for people of all skill levels to access data and apply mixed reality to visualize it
  - Cultivate community interest in data—approachable ways to view data and engage communities
  - Opportunity to show truth through data; ask for evidence
  - Make software partners easy to find
- Address the risks of using Mixed Reality as a training tool
  - Loss of human communication

- Where is the line for technology overload?
- How much can we accomplish virtually until we reach the limit?
- Would continuous learning be beneficial in technology training?
- Considering the ethics of data use around mixed reality is essential
- Consider how jobs will evolve through technology innovations; if automation eliminates some low-skill jobs how do we ensure access to education for all so that all workers have opportunities to succeed. What will the University of the future look like?

## ***NeuroReality and The Future of Work – Mind Transcending the Barriers of Body to Achieve the Full Human Potential***

### **Dustin Tyler**

NeuroReality as the transformative future of virtual reality was the context for this breakout. NeuroReality is the meaningful and ethical evolution of the connection between humans and technology enabling the mind to transcend the physical barriers of the body to achieve our full human potential. What this means for the future of work: “Anything, Anytime, Anyone, Any team, Anywhere.”

### **Key Takeaways**

- **Opportunity**
  - Social Connectivity/Empathy
  - Distribution of Experience (not knowledge per se)
  - Globalization of community
  - Remote operability or separating the individual from a harmful environment (examples: setting off explosives, working in the clean up after the Fukushima mishap, space)
  - New business opportunities
- **Barriers**
  - Value vs. Sacrifice (trade-offs) Examples: Perceived values include free-time, simplicity, not dying... Sacrifices: getting an implant/device, financial costs, control of data and privacy issues
- **Other**
  - Personalize the experience
  - Keep it human centered
  - Identify the right audience—high stakes vs public

## Theme 2: Setting Stage – Illuminating the Socio-Technological Landscape

After the Theme 1 report out session, **Dr. Suzanne Rivera**, Vice President of Research and Technology Management, CWRU, introduced the topics and speakers for the second theme, Illuminating the Socio-Technological Landscape.

Just as for Theme 1, speakers introduced individual topics that were later discussed in-depth in a breakout session. The topics under Theme 2 were:

Theme 2 Breakout Session Topics	Speaker
Thriving in the New Socio-Technological Landscape(s): Education and Employment	Brian Gran
The Role of Artificial Intelligence Assistance on Human Skill in the Workforce	Brooke Macnamara
The Future of Farming and Feeding	Darcy Freedman
Ethical Considerations for Future Workers: Maintaining Autonomy and Accountability in Increasingly Automated Workplaces	Shannon French

## Theme 2 – Summary of Breakout Sessions

Key takeaways from each breakout session are summarized below.

### ***Thriving in the New Socio-Technological Landscape(s): Education and Employment***

#### **Brian Gran**

Topics covered revolved around the impact of technological advancements on education and employment, both on a national and global level, and the effects of bootstrapping.

#### **Key Issues**

- Climate change
- Human endeavors (Haves and have nots)
  - Concerns about the “Digital divide:” those on the wrong side may not keep pace in terms of *digital literacy*
  - The potential impact of technology on brick and mortar educational institutions.
  - The impact of currently demonstrated automation technologies on global economy, wages and workers
- Skills gap between what universities are teaching vs employer needs
- Role of government/legislation is unclear – hindrance or help?

#### **Key Takeaways**

- The lack of digital infrastructure is holding back digital benefits in many economies, both developing and developed
- Routine skills are *less* needed in the job market now and in the future
- Enduring and essential human skills such as empathy, creativity and enthusiasm for learning will be key, along with the ability to embrace change and uncertainty
- Make an effort to avoid unintended consequences

## The Role of Artificial Intelligence Assistance on Human Skill in the Workforce

Brooke Macnamara

Discussion centered around whether repeated use of artificial intelligence in the workplace causes skill atrophy in human experts, and/or if use of artificial intelligence assistance during training hinders learning.

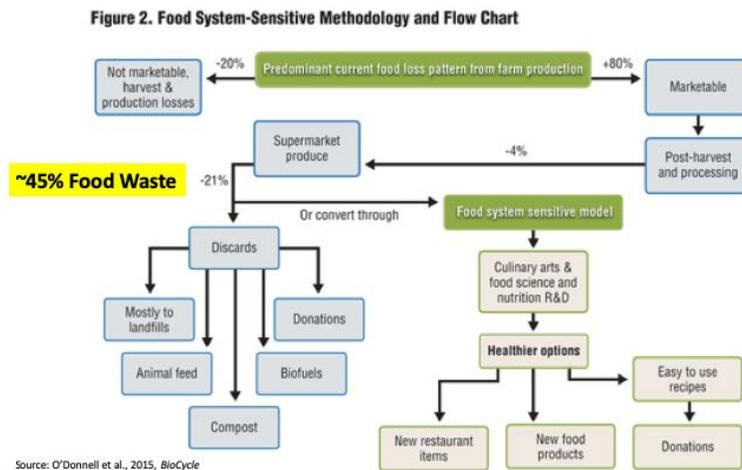
### Key Takeaways

- Should we make time to prevent the atrophy of certain skills?
- Two AI's may reach different conclusions because they are not as content or context sensitive as humans
- Difficult to test this in a lab
- Do AI assistants hinder a specific ability (e.g., not being able to remember phone numbers) or do they impede the broader ability (memorization in general)?
- Can we use AI to reskill or remind ourselves of where we have atrophied?

## The Future of Farming and Feeding

Darcy Freedman

This session focused on the interplay between the food supply chain and human health issues with a focus on the role of food systems as a driver of population health, and the role that technology can potentially play in addressing chronic health issues, narrowing the urban/rural divide and moving toward agricultural specialization.



Food System-Sensitive Methodology and Flow Chart

### Key Takeaways

- Sustainability development goals
  - Can we have food security on University Campus?
  - How do you recruit people for this field?
  - What about transportation?
  - How can technology be used to make produce less costly?
- Who is farming?
  - Does farming increase mental illness
- Urban/ Rural divide (American vs. the rest of the world)
- How can technology support farming?
  - How do we engage the rural communities in using technology to support farming?
  - Is technology relatable to people in the rural communities? (connection + accessibility to those in small towns)
  - Can we connect rural communities involved in farming to technology that could help with mental health?
- What does the future of work look like in Food Service?

- Are there ways to make rural areas “specialized hubs”?
- Technology and Health—can technology make cooking more convenient to do? Are there ways to incorporate community space(s) for cooking?

## ***Ethical Considerations for Future Workers: Maintaining Autonomy and Accountability in Increasingly Automated Workplaces***

**Shannon French**

Impacts to worker autonomy and accountability in the face of advances in automation, and possible remedies, were examined in this session.

### **Key Takeaways**

- Humans are trading privacy for convenience, despite concerns around data ownership. Examples considered, Global Entry, Face App, Disney experience card
- Who owns my data?
- There is a generational/demographic variance in attitudes toward data privacy. Baby boomers and generations prior to theirs are more concerned about data privacy than their younger counterparts
- Value of privacy is shifting based on priorities
- Importance of collaborations involving multi-disciplinary teams (e.g., science and technology, ethics, law, sociology, etc.) from the start, (designing /strategy phase) of the project to ensure accountability
- Include a human element at the center
- Can we use electronic ethics reminders (non-punitive) to assist individuals when they make/ need to make “tough choices”?

## **Next Steps**

**Dr. Anthony Boccanfuso**, President, UIDP, explained the next step for the UIDP listening series and asked the guests to consider follow-on activities to leverage the “knowledge gained/lessons learned” at the breakout sessions and use those to further maximize collaborations and partnerships in the Future of Work space.

## **Closing Comments**

**Nick Barendt**, Executive Director of ISSACS, CWRU shared the overall takeaways for the day and thanked the participants for identifying and evaluating opportunities for university-industry collaborations (within the Future of Work at the Human-Technology Frontier) where collaborations will yield the most impactful results.

# Overall Session Takeaways

- Need for a cultural shift in human-machine/AI relationships; from an atmosphere of fear to human-centered, symbiotic relationships between humans and technology
- Address the implications of augmentation and automation on society
- Address concerns around equity – we need to be intentional in our efforts to ensure augmentation/automation benefits many instead of a few
- Emphasis on transparency around the good and bad outcomes of augmentation
- Address concerns around the effects of augmentation/automation on what it means to be human – autonomy, ability to affect others/the world, accountability, emotion, experience and embodiment
- Potential for erosion of skills, values, emotions and connection to others
- Address concerns around data: privacy, ownership, information control, algorithmic biases
- Democratize data access to circumvent exploitation
- Researchers, scientists and technologists (academia) need training in the dissemination of the implications/applications of their work to wider audiences (communities, general population)

