OECD (経済協力開発機構) 技術予測フォーラム 報告

Dec. 15, 2016
総務省「AIネットワーク社会推進会議」

中央大学 総合政策学部 教授
大学院 総合政策研究科 委員長
平野　晋

OECD Technology Foresight Forum on Artificial Intelligence
Nov. 17, 2016
@ OECD Conference Centre
2, rue André Pascal
75775 Paris Cedex 16, France

OECD-TFF紹介ページと雰囲気

Available at <http://www.oecd.org/sti/ieconomy/technology-foresight-forum-2016.htm>
(last visited Dec. 6 2016).

- 会場は立ち見が出る程の盛況ぶり（通常は空席が目立つとのこと）。

主要スピーチの要点

- アンドリュー・ワイコフ氏(*1)の冒頭陳述
  - (*1) Director, Science, Technology and Innovation
  - 後述
- 小職のスピーチ
  - 後述
- クロサカ先生のスピーチ
  - クロサカ先生から
- アン・カブラン女史(*2)の最終陳述
  - (*2) Head of Division on Digital Economy Policy
  - 後述

議題＆発表者等（1/2）

Agenda and presentations

This meeting was Chaired by: Mr. Jörgen Abild Andersen, Chair of the Committee on Digital Economy Policy

1. **Welcome remarks**

Mr. Andrew Wyckoff, Director for Science, Technology and Innovation, OECD

2. **Key Artificial Intelligence (AI) Developments and Applications: Today and Tomorrow**

Following an introduction to AI, the panel discussed the state of AI development today including recent break-throughs and key applications and opportunities offered by AI in areas ranging from social networking and advertising to healthcare and transportation. Panellists will also be asked to share insight on key opportunities and challenges raised by AI and on public policy issues priorities in this area.

Speakers

Mr. Yves Demazeau, Research Director, Centre national de la recherche scientifique (CNRS), France (Presentation)

Mr. Olivier Ezratty, Innovation Strategies Consulting (Presentation)

Mr. Jonathan Sage, Governmental Programmes Executive, EMEA lead on cyber security and cloud computing policy, IBM (to be added shortly)

Ms. Ophélie Gerullis, Public Policy Manager, Facebook (Presentation not available)

Ms. Lynette Webb, Senior Manager, European Policy Strategy, Google (Presentation)

Q&A and discussion - Forum speakers and Committee delegates

- What are the potential applications of AI in service industries such as healthcare or customer service?
- Can a distinction be made between AI used in the digital-world and AI physical-world applications like driverless cars or industrial robots?
- What future AI applications are foreseen? What opportunities does AI raise for public sector services and areas like education, healthcare, defence or environmental protection? What impact on growth and productivity? What challenges?

Available at <http://www.oecd.org/sti/ieconomy/technology-foresight-forum-2016.htm>
(last visited Dec. 11, 2016) (emphasis added).

議題＆発表者等（2/2）

3. **Artificial Intelligence and Society: the Challenges Ahead**

Speaker

Ms. Yuko Harayama, Executive Member, Council for Science and Technology Policy, Cabinet Office of Japan (*via video link - Presentation*)

4. **Public Policy Considerations Raised by AI**

The panel considered some of the public policy considerations raised by AI, notably its implications for jobs, skills and education, but also ethical concerns, liability and responsibility questions, geopolitical implications and social inclusion issues.

Speakers

Mr. Susumu Hirano, Faculty of Policy Studies／Professor, Dean, Graduate School of Policy Studies, Chuo University (Presentation)

Ms. Joanna Bryson, Reader at University of Bath, and Affiliate, Center for Information Technology Policy at Princeton University (Presentation)

Mr. Cyrus Hodes, Director for Artificial Intelligence and Representative for the MENA Region, The Future Society @ Harvard Kennedy School of Government (Presentation)

Ms. Cornelia Kutterer, Director of Digital Policy, Microsoft EMEA (Presentation)

Mr. Tatsuya Kurosaka, Project Assistant Professor at Keio University Graduate School of Media and Governance (Presentation)

Q&A and discussion - Forum speakers and Committee delegates

- Are policy makers sufficiently aware of AI? What role for government, academia, companies and civil society?
- Will AI augment or replace human labour? In what occupations? What skills will humans need?
- Who will control AI technology? Who will reap the benefits of AI?
- How can we minimise ethical risks? Who is responsible for AI decisions?
- Can existing Digital Economy Policy principles help address AI issues? What role for industry self-regulation, policy interventions and international co-operation?

5. **Wrap-Up and Next Steps**

Ms. Anne Carblanc, Head of OECD Division on Digital Economy Policy

Available at <http://www.oecd.org/sti/ieconomy/technology-foresight-forum-2016.htm>
(last visited Dec. 11, 2016) (emphasis added).

アンドリュー・ワイコフ氏

1. **WELCOME REMARKS**

Mr. Andrew Wyckoff, Director for Science, Technology and Innovation, OECD

Andrew W. Wyckoff is the Director of the OECD's Directorate for Science, Technology and Innovation (STI) where he oversees OECD's work on innovation, business dynamics, science and technology, information and communication technology policy as well as the statistical work associated with each of these areas. His experience prior to the OECD includes positions at the US Congressional Office of Technology Assessment (OTA), the US National Science Foundation (NSF) and The Brookings Institution.

Available at http://www.oecd.org/sti/ieconomy/Final%20AI%20TFF%20bio%20book.pdf (last visited Dec. 11, 2016)

A. ワイコフ氏の冒頭陳述

- 高松におけるG7情報通信大臣会合にも言及しつつ、日本が意欲的に取り組んでいる旨を褒めるような調子で紹介。

小職の発表

- 発表時間を9分40秒程に収めるようにとの指図ゆえに、コンサイスに主張を指摘。

写真は、セッション開始前の様子。

小職の発表概要

- <u>総務省が有識者会議を開催して検討</u>して来たこと。
  - 「AIネットワーク」の概念・発展将来像を説明。
- 高松の<u>G7情報通信大臣会合にて高市大臣がAI開発原則を発表</u>し、<u>賛成</u>を得られていること。
- 引き続き「<u>社会推進会議</u>」と2つの「<u>分科会</u>」にて、<u>内容を洗練化・構築中</u>であること。
- <u>来年3月には東京で国際シンポ</u>を開き、世界に提示する意欲・予定であること。
- <u>トロッコ派生問題</u>に8原則（透明性）を当てはめて、<u>8原則の重要性を指摘</u>。
- まとめ：　日本が<u>国際社会に貢献</u>できるように望んでいることを強調。
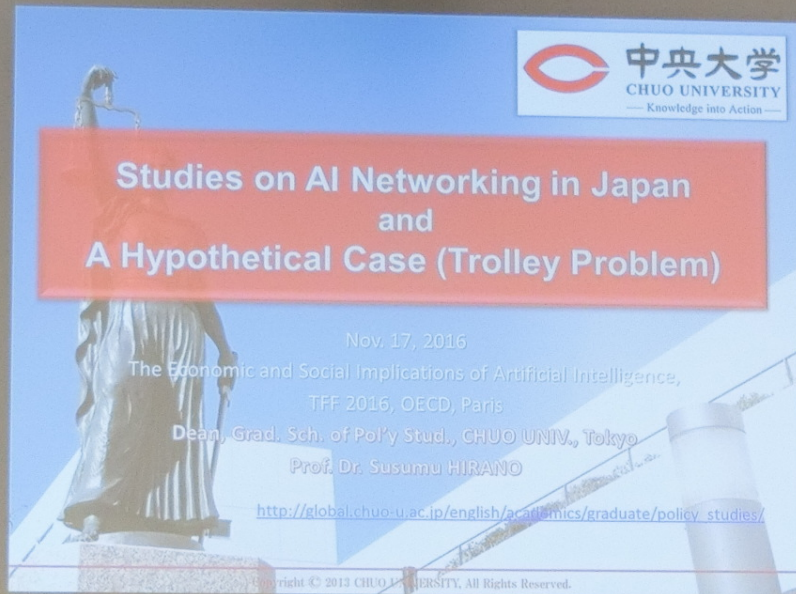
使用スライドは、以下のURLで公表中 <http://www.oecd.org/sti/ieconomy/Prof%20Hirano%20AI%20Foresight%20Forum%20Nov%202016.pdf> (last visited Dec. 11, 2016)
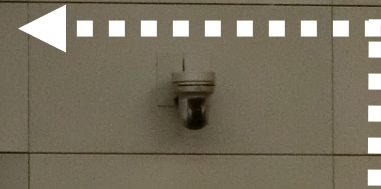
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Studies on AI Networking in Japan and A Hypothetical Case (Trolley Problem)

Nov. 17, 2016

The Economic and Social Implications of Artificial Intelligence,

TFF 2016, OECD, Paris

Dean, Grad. Sch. of Pol'y Stud., CHUO UNIV., Tokyo

Prof. Dr. Susumu HIRANO

http://global.chuo-u.ac.jp/english/academics/graduate/policy_studies/

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Studies on AI Networking by MIC of Japan (Chronology)

February, 2015

Study Group concerning the Vision of the Future Society Brought by Accelerated Advancement of Intelligence in ICT

June 30, 2015   **Report 2015**

February, 2016

Conference on Networking among AIs

April 15   **Interim Report "Wisdom Network Society (WINS) Produced by the Networking among AIs"**

[April 29 and 30   G7 ICT Ministers' Meeting in Takamatsu, Kagawa]

June 20, 2016   **Report 2016 "Impacts and Risks of AI Networking"**

October, 2016

Conference toward AI Network Society

Idea of "AI Networking" and Stages of Its Progress

The AI Networking

(i) Establishment of "AI Network Systems (*)"; and (ii) advancement thereof thru. the coordination among the AI Network Systems, etc.

(*) The term, "AI Network Systems," means information-and-communications-network systems that include AI as their component.

Stages in progress of the AI Networking
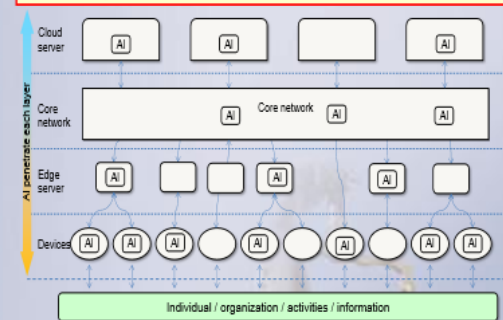
(1) AI functions independently from the Internet, etc. to assist human beings without coordination with other AI. (stand-alone AI)

(2) Networks of AI are formed and autonomous coordination and autonomous harmonization progress in various sectors of society.

- ■ Various AI with different uses appear on the network.
- ■ AI with the ability to coordinate multiple AI also appear.
- ■ Multiple AI collaborate and work in harmony with one another.

(Examples)
- · Coordination of industrial machinery and construction members, coordination between service robots and sensors.
- · Autonomous coordination of transport, logistics, office work, living environments etc.

AI penetrate each layer of the information and communications network and collaborate and coordinate with one another

Cloud server | Core network | Edge server | Devices

AI penetrate each layer

Individual / organization / activities / information

(3) Latent capabilities of human beings are drawn out by the AI network system, resulting in both physical and intellectual development. (enhancement of human beings)

Coordination of sensors, actuators, AI, and human beings

Improved sensory organ capabilities

Improved capabilities of the human body

(Examples) Information in the brain is output externally.
- · Artificial arms, legs, and robots are operated by human thought.
- · Virtually experiencing events in remote locations.
- → Cooperative operation of robots in remote locations.

(4) Coexistence of human beings and the AI network system

Future Challenges

1. **Formulation of Basic Principles for Research and Development "AI R&D Guidelines"**
2. Facilitation of Cooperation toward the Development of AI Networking
3. Securing of Competitive Ecosystem
4. Challenges for Promotion of Economic Development and Innovation
5. Setting Evaluation Indices on Impact of Development of AI Networking and Richness- and Happiness-related Indices
6. Protection of Users
7. Ensuring Security for the AI Networking
8. Institutional Issues relating to Privacy and Personal Data
9. Institutional Issues relating to Content
10. Study of Basic Rules of Society
11. Creating and Sharing Risk Scenarios
12. Accelerated Advancement of Information and Communications Infrastructure
13. Prevention of the Formation of AI Network Divides
14. Issues related to Ideal State of Human Existence
15. Fostering of AI Network System Literacy
16. Personnel Training for the AI Networking
17. Improvements in Working Environments in Response to AI Networking
18. Establishment of a Safety Net
19. Contribution to Human Happiness through the Resolution of Global Issues
20. Approach to Governance of the AI Network Systems

Formulation of AI R&D Guidelines

Similar to the OECD guidelines on the protection of privacy and transborder flows of personal data, the OECD guidelines for the security of information systems and networks, and the OECD guidelines for cryptography policy, it is necessary to initiate discussions and considerations in the OECD and other organizations, with the involvement of the stakeholders concerned, toward formulating <u>international guidelines (tentatively named "AI R&D Guidelines") consisting of principles and their explanations to be taken into account in R&D of AI as a non-binding framework</u>.

【Basic approach to formulation and interpretation of basic principles】
The following approach should be noted in the preamble as the basic approach.

(1) A society which could implement the following should be aimed for:
- ・ The benefits of the AI network system should be received by everyone;
- ・ Human dignity and personal autonomy should be protected;
- ・ The controllability and transparency of the AI network system should be ensured; and
- ・ The AI network system should be used safely and securely.

(2) The various risks which might occur in each stage in progress of R&D should be handled timely as well as appropriately.

(3) A balance between relevant values and interests should be maintained with the involvement of various stakeholders, with due consideration given to necessity for innovative R&D and fair competition.

(4) The guidelines should be reconsidered as needed in response to the progress in the AI Networking and the emergence of risks.
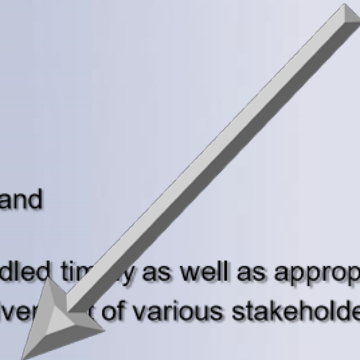
【Content of basic principles 】
At least the following should be incorporated into basic principles.

(1) Principle of transparency: The ability to explain and verify the operation of the AI network system should be ensured.

(2) Principle of user assistance: The consideration should be given so that the AI network system could assist users and appropriately provide users with opportunities to make choices.

(3) Principle of controllability: The controllability of the AI network system by humans should be ensured.

(4) Principle of security: The robustness and dependability of the AI network system should be ensured.

(5) Principle of safety: The consideration should be given so that the AI network system would not cause danger to the lives/bodies of users or third parties.

(6) Principle of privacy: The consideration should be given so that the AI network system would not infringe the privacy of users or third parties.

(7) Principle of ethics: Research and development of the AI network system should respect human dignity and personal autonomy.

(8) Principle of accountability: The AI network system researchers and developers should be accountable to related stakeholders including users.
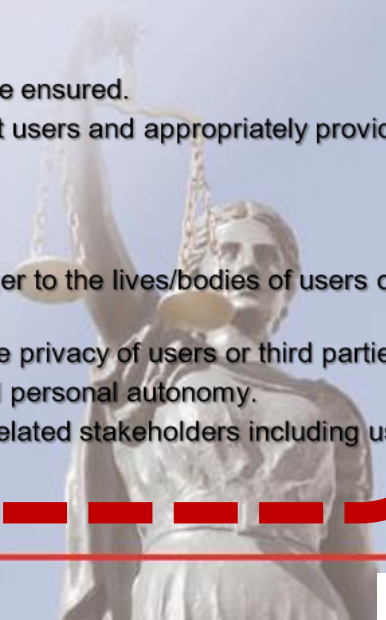
Sanae TAKAICHI, Minister for Internal Affairs and Communications, proposed that each G7 country should take the lead under the cooperation of the OECD and other international organizations in working together with stakeholders concerned with the industrial, academic, civil, and governmental sectors to progress international discussions over the socioeconomic impact of AI networking and social, economic, ethical, and legal issues on AI networking, including the formulation of AI development principles*. The participated countries agreed to Minister TAKAICHI's proposal.

*A tentative plan on AI development principles consisting of eight items was distributed prior to the proposal from Minister TAKAICHI.

Distributed material

Proposal of Discussion toward Formulation of AI R&D Guideline

Referring OECD guidelines governing privacy, security, and so on, **it is necessary to begin discussions and considerations toward formulating an international guideline consisting of principles governing R&D of AI to be networked** ("**AI R&D Guideline**") as framework taken into account of in R&D of AI to be networked.

Proposed Principles in "AI R&D Guideline"

1. Principle of Transparency
Ensuring the abilities to explain and verify the behaviors of the AI network system

2. Principle of User Assistance
Giving consideration so that the AI network system can assist users and appropriately provide users with opportunities to make choices

3. Principle of Controllability
Ensuring controllability of the AI network system by humans

4. Principle of Security
Ensuring the robustness and dependability of the AI network system

5. Principle of Safety
Giving consideration so that the AI network system will not cause danger to the lives/bodies of users and third parties

6. Principle of Privacy
Giving consideration so that the AI network system will not infringe the privacy of users and third parties

7. Principle of Ethics
Respecting human dignity and individuals' autonomy in conducting research and development of AI to be networked

8. Principle of Accountability
Accomplishing accountability to related stakeholders such as users by researchers/developers of AI to be networked

Contributions toward Formulating Guidelines

- ➤ MIC of Japan assembled "the Conference toward AI Network Society" in this October, for the sake of contribution to discussions and considerations in the OECD on social, economic, ethical, and legal issues caused by AI networking. The conference will make a draft of the "AI R&D Guidelines," for international discussions and considerations in the OECD, as well as analyze details of social and economic impacts and risks caused by AI networking.

- ➤ In March 2017, in Tokyo, MIC will hold the international symposium on AI networking. In the symposium, Japan intends to introduce the progress in considerations by the Conference toward AI Network Society. Japan would like to hold this symposium to accelerate international communities' discussions on and formulation of "AI R&D Guidelines."

Structure and Study Items of the Conference toward AI Network Society

Conference toward AI Network Society

[Study items] Social, economic, ethical, or legal issues caused by AI networking
- Issues and institutional matters related to AI research and development principles (→ Subcommittee on AI R&D Principles)
- Matters related to the evaluation of impacts and risks caused by AI networking (→Subcommittee on Impact and Risk Assesment)

Subcommittee on AI R&D Principles

[Study items] Issues and institutional matters related to AI R&D Principles
- Issues and matters related to AI R&D Principles and guidelines (including drafting for international discussions at OECD, G7, etc.)
- Institutional matters related to principles and guidelines

Subcommittee on Impact and Risk Assessment

[Study items] Matters related to the evaluation of impacts and risks caused by AI networking
- Evaluation of positive impacts and challenges in each field
- Evaluation of risks in each field (via Risk Scenario Analysis)
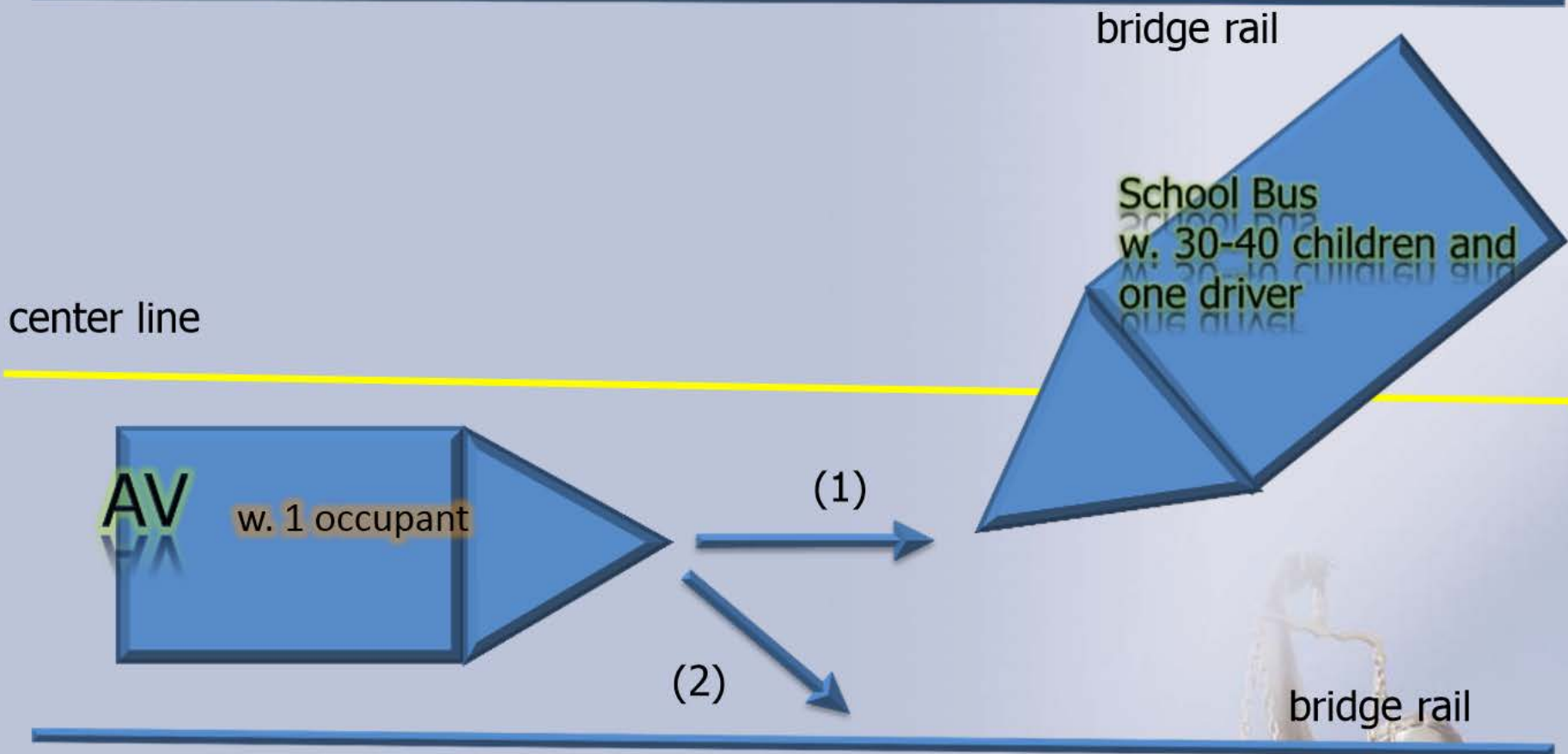- Other influences caused by AI networking, etc.,

Hosting

International Forum toward AI Network Society

Participation

Various Kinds of Stakeholders
(Government, industries, academia, citizens, and international organizations)

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The Bridge Problem (1/2)

bridge rail

School Bus
w. 30-40 children and
one driver

center line

AV   w. 1 occupant

(1)

(2)

bridge rail

Drawn by Hirano based upon hypos. *in* Clive Thompson, *Relying on Algorithms and Bots Can Be Really, Really Dangerous*, WIRED, Mar. 25, 2013, *available at* https://www.wired.com/2013/03/clive-thompson-2104/ (last visited Oct. 25, 2016) (originally in Gary Marcus, *Moral Machines*, New Yorker Blogs, No. 27, 2012, *available at* http://www.newyorker.com/news/news-desk/moral-machines (last visited Oct. 25, 2016)); Jeffrey K. Gurney, *Crashing into the Unknown: An Examination of Crash-Optimization Algorithms through the Two Lanes of Ethics and Law*, 79 ALB. L. REV. 183, 261 (2015-2016).

Application of the AI R&D Principles to the Bridge Problem (1/2)

- **<u>1st Principle of Transparency</u>**: Ensuring the abilities to explain and verify the behaviors of the AI network system

  - Manufacturers might manipulate the AI <u>in a convert manner</u> so that the AV would always choose to protect its occupant(s) by sacrificing the school bus's 30-40 children. *See* Noah J. Goodall, *Ethical Decision Making during Automated Vehicle Crashes*, 2424 TRANSPORTATION RESEARCH RECORD: J. TRANSP. RESEARCH BD. 58, 63 (2014) ("A self-protection component built into the automated vehicle's ethics <u>could be hidden in a complicated neural network</u> and <u>discoverable only through the analysis of long-term crash trends</u>. Safeguards must be in place to ensure that such a thing does not happen." (emphasis added)).

- **<u>2nd Principle of User Assistance</u>**: Giving consideration so that the AI network system could assist users and appropriately provide users with opportunities to make choices

  - The Manufacturer's choice (1) rather than (2) might be against the occupant's choice if the manufacturer has done so without taking into account the occupant's intent. (*I.e.*, Some occupants might prefer the choice (2).)

- **<u>7th Principle of Ethics</u>**: Respecting human dignity and individuals' autonomy in conducting research and development of AI to be networked

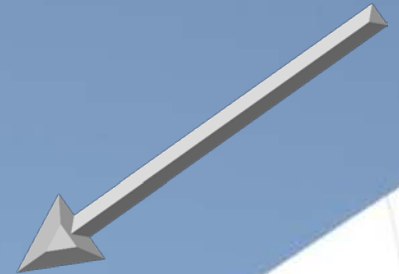 - Is the choice (1) ethically correct or in compliance with human dignity?

質疑応答の概要

質疑応答の概要

- 会場の意見は、日本の開発8原則の提案に対し、概ね賛成の雰囲気が大勢であったと感じられた。

- 以下の諸原則に関する重要性を認識したような発言が目立つように感じられた。
  - 「① 透明性の原則」、
  - 「⑦ 倫理の原則」、及び
  - 「③ 制御可能性の原則」。

アン・カブラン女史の最終陳述

アン・カブラン女史の最終陳述

Available at http://www.oecd.org/sti/ieconomy/Final%20AI%20TFF%20bio%20book.pdf (last visited Dec. 11, 2016)

- 日本からのAI開発に関する国際的なガイドラインの提案を踏まえつつ、来年9月又は10月のOECD・日本共催のシンポジウム、来年11月のCDEPにおいて、各国と議論を行い、肯定的な反応が示されれば、2018年の勧告化に向けたプロセスに進みたい。

ご清聴、有難う御座いました。

Impacts and Risks Caused by AI Networking, and Future Challenges

(From Studies on AI Networking in Japan)

November 17, 2016

Tatsuya KUROSAKA

Project Assistant Professor at Keio University
Graduate School of Media and Governance

Evaluation of Social and Economic Impacts Caused by AI Networking

"Conference on the Networking among AIs" evaluated social and economic impacts caused by AI networking in the time series from 2020s to 2040s in each field of public, life, and industrial areas.

[Public area] Public infrastructure, disaster prevention, smart cities, public administration.

[Life area] Life support (personal assistance), creation of richness.

[Industrial area] Common matters (corporate business, etc.), agriculture, forestry and fisheries, manufacturing, transportation and logistics, wholesale and retail, finance and insurance, medical and nursing care, education and research, service industry, construction.

[Sample 1] Manufacturing

It is expected that smart manufacturing processes and supply chains will emerge around 2020, and production optimization and advanced multi-product variable production (customization) will be realized in response to the dynamic balance of demand and supply.

In addition, digital marketing, high value-added after-sales service, and maintenance services based on the analysis of operational data on users will be realized.

Furthermore, the automation of production beginning with the design phase of products is expected in the second half of the 2020s, and efficiency and speed improvements in development work will be realized.

2020   2030   2040

▲ Widespread use of cooperative robots that can work with people [MRI]
▲ Realization of unmanned maintenance[*2] (2020) [Future]
▲ Improvements in product demand prediction and the efficiency of supply chains based on real-time data [I4.0]
▲ Lead-time reduction through the use of demand data [I4.0]
▲ Realization of smart industrial robots and machine tools for advanced multi-product variable production (mass customization)[*1] (2020) [Future]
▲ Realization of a significant reduction in construction time by on-demand manufacturing at mobile factories (2020) [Future]
▲ Realization of high value-added after-sales service and maintenance service based on the analysis of operational data on users using the products. (2020) [Future]
▲ AI robots will learn skilled workers' intuition and knack [MRI]
▲ Introduction of AI in the designing, prototyping, and testing of products for improvements in product development efficiency and speed [MRI]
▲ Improvements in product cost performance [MRI]
▲ Emergence of autonomous robots that can respond to complex environmental changes, such as production stage changes (2029) [White Paper]
▲ Realization of zero design lead time and zero inventory" (2030) [Competition]
▲ Transition from standard products to tailor-made products (2030) [Competition]
▲ Standardization of large companies' unmanned plants [MRI]
▲ Semi-automation and full automation of product designing [MRI]

*1. AI will predict the future demand for products from consumers' purchasing behavior.
*2. Free of manual maintenance.

[Sample 2] Medical and nursing care

The disease prediction of patients based on their vital data and the health management of people based on their gene information will be realized, thus resulting in an extension of healthy life expectancy.

It is expected that the automatic analysis of research papers will be realized in the 2030s, and medical research and new drug development will be accelerated.

2020   2030   2040

▲ Use of AI diagnosis support to improve diagnosis accuracy and reduce misdiagnosis [MRI]
▲ Practical application of guidance robots for the visual impaired (2016) [White Paper]
▲ Marketing of pushcart-type walking aids equipped with sensors [White Paper]
▲ Practical application of technologies to detect abnormalities in motor functions that are not detected by body sensors, etc. (2017) [White Paper]
▲ Dissemination of second opinion services using AI [MRI]
▲ Dissemination of services to predict disease onset based on vital data [MRI]
▲ Practical achievement of diagnostic imaging and automatic detection of lung cancer, etc. [MRI]
▲ Practical achievement of health management using genetic information (2020) [Future]
▲ Automatic pharmaceutical preparation [MRI]
▲ Health management through ubiquitous biological information monitoring (2023) [White Paper]
▲ Improvement of senior citizen QOL through the use of actuator technologies that can assist motor functions (2023) [White Paper]
▲ Expansion of second careers and the senior economy through extension of healthy life [MRI]
▲ Practical application of assistance network robots that help senior citizens get out of the house (2028) [White Paper]
▲ Use of sensors and actuators to support medicine, healthcare, health maintenance, and activities of people with disabilities* (2030) [Hirai, Member]
▲ Dissemination of functions to improve dementia and strengthen cognitive ability [MRI]
▲ Dissemination of new drug development by pharmaceutical companies using AI [MRI]
▲ Reduction of medical costs through extension of healthy life [MRI]

* Specific examples: Support for operations through monitoring of accident status, etc., social welfare and infrastructure construction to monitor abnormal behavior and provide healthcare and independent living assistance, etc., and two-way remote medicine, etc.

Examples of Social and Economic Impacts (1/3)

Fields	Examples of Impacts
Public area (community)	
Public infrastructure	- The real-time collection and analysis of data on the supply and demand of public infrastructure will enable an immediate response to sudden environmental changes. - The automation of maintenance will achieve efficiency.
Disaster prevention	- The real-time prediction of the influence of disasters will increase in sophistication, and evacuation guidance linking with the prediction will lessen the damage.
Smart cities	- The utilization of street cameras and the realization of energy management will realize comfortable, safe, and efficient cities.
Public administration	- The utilization of the AI analysis result of open data on relevant policies and institutions will benefit to level improvements in public administration. - With the realization of forecasting utilizing information transmitted from each individual and enterprise, the planning of policies that are more precise will be possible.
Life area (people)	
Life support (personal assistance)	- By utilizing body and indoor sensors and robots, housework and chore support will decrease the load of human. - AI capable of exchanging a natural conversation with humans will appear around 2030.
Creation of richness	- Personal fabrications will become widespread and product and service users' own customization will occur as common matters. - Encounter support and experience sharing will be sophisticated as a result of the development of sensors and media, and a possibility of qualitative changes people's connections will be expected.

Examples of Social and Economic Impacts (2/3)

Fields	Examples of Impacts
Industrial area (work)	
Common matters (corporate business, etc.)	- The automation of simple tasks, such as back-office operations, customized for each individual (e.g., personal secretarial services) will achieve work efficiency.
Agriculture, forestry, and fisheries	- Automatic cultivation, agricultural drones, intelligent farming, and other innovations will improve production efficiency and a yield expansion.
Manufacturing	- Smart manufacturing processes and supply chains will realize production optimization and advanced multi-product variable production (mass customization), in response to the dynamic balance of demand and supply. - Based on the analysis of operational data on users, digital marketing, high value-added after-sales service and maintenance service will be realized. - The automation of production beginning with the design phase of products is expected in the second half of the 2020s, and efficiency and speed improvements in development work will be realized.
Transportation and logistics	- The reduction of accidents, elimination of traffic congestion, the reduction of environmental impacts, and resolution of regional "traffic refugees," including elderly people, will be achieved as a result of level improvements in autonomous driving.
Wholesale and retail	- The utilization of the analysis results of data on customers of intelligent commerce, purchase recommendations, etc., will stimulate customers' consumption.
Finance and insurance	- The sophistication and divergence of products and services will be expected as a result of the refinement of risk assessment. - The automation of trading, loan screening, and credit management will become widespread around 2030.

Examples of Social and Economic Impacts (3/3)

Fields	Examples of Impacts
Medical and nursing care	- The disease prediction of patients based on their vital data and the health management of people based on their gene information will be realized, thus resulting in an extension of healthy life expectancy. - Medical research and new drug development will be accelerated by the automatic analysis of research papers.
Education and research	- Detailed education, ranging from the learning of subjects to career development, according to each individual will make progress. - The tacit knowledge of excellent performers, skilled technicians, and creators will be formalized and archived, which will improve education efficiency.
Service industry	- The automation of comparatively simple jobs in security service, backyard work, and response services at call centers will make progress. - The automatic evaluation of the reasonable prices of real estate will facilitate real estate transaction.
Construction	- The introduction of robot technology to dangerous work and painful work will make it easier to work on construction site for women and elderly people. - Sensors that will detect the deterioration of structures and new functional materials as a result of advanced data analysis will be developed, which will further enhance the safety of buildings.

Risks Caused by AI Networking (1/2)

The conference classified social, economic, ethical, and legal risks caused by AI networking as follows*.

1. Risks Associated with Functions： Functions that are expected in the AI network system do NOT work appropriately.

2. Risks related to Legal System, Rights, or Interests: AI network system infringes rights or interests.

   * *Some risks have both sides. (example: Risk of accident)*

For studying the ideal state of evaluation and management of risks, examination of scenarios that imagine an actual applications of AI network system will be needed. (*I.e.*, Risk scenario analysis)

Type of Risks	Examples
Risks Associated with Functions	
Security-related risks	- Hacking and cyber attack on AI network system. - Surreptitious attack on AI network systems without attracting anyone's attention.
Risks related to information and communications network systems.	- Occurrence of unintended situation caused by intermingled with various AI in information communication network. - Occurrence of unintended situation caused by irregular work of AI when information communication network has some trouble. - Data leak and data loss from clouds, and system failure.
Opacification risks	- As AI algorithm becomes opacified, appropriate control of AI network system becomes difficult for human.
Risks of control loss	- As AI network system runaways, control by human becomes difficult or impossible.

Risks Caused by AI Networking (2/2)

Type of Risks	Examples
Risks related to Legal Sys, Rights, or Interests	
Risks of accidents	- Accident by the action of an autonomous vehicle or robot on an autonomous decision basis.
Risks of crimes	- Crime by malware abusing AI network system. - Terrorism or crime by autonomous weapon system.
Risks related to the rights and interests of consumers, etc.	- Inappropriate application of AI network system infringes rights and interests of consumers and young people, etc.
Risks related to the infringement of privacy and personal information	- As collection and application of personal information by AI network system becomes opacified, control of personal information becomes difficult. - AI network systems infringe privacy by surmising people's intentions, health, or future actions, etc.
Risks related to human dignity and the autonomy of each individual	- AI network systems infringe individual autonomy by invisible manipulation of human's decision making processes. - Collapse of the value system of the human-central principles by the technological singularity.
Risks related to democracy and governance mechanisms	- AI network system's bad influence on voting and people's behavior. - As AI network system is applied to the governance of the nation, decision making processes become opacified and the location of responsibility turns ambiguous.

Future Challenges

1. Formulation of Basic Principles for Research and Development "AI R&D Guidelines"
2. Facilitation of Cooperation toward the Development of AI Networking
3. Securing of Competitive Ecosystem
4. Challenges for Promotion of Economic Development and Innovation
5. Setting Evaluation Indices on Impact of Development of AI Networking and Richness- and Happiness-related Indices
6. Protection of Users
7. Ensuring Security for the AI Networking
8. Institutional Issues relating to Privacy and Personal Data
9. Institutional Issues relating to Content
10. Study of Basic Rules of Society
11. Creating and Sharing Risk Scenarios
12. Accelerated Advancement of Information and Communications Infrastructure
13. Prevention of the Formation of AI Network Divides
14. Issues related to Ideal State of Human Existence
15. Fostering of AI Network System Literacy
16. Personnel Training for the AI Networking
17. Improvements in Working Environments in Response to AI Networking
18. Establishment of a Safety Net
19. Contribution to Human Happiness through the Resolution of Global Issues
20. Approach to Governance of the AI Network Systems

Relationship between Future Challenges and four types Issues

	Institutional issues	Economic issues	Social and ethical issues	Technical issues
1. Formulation of Basic Principles for Research and Development "AI R&D Guidelines"	◎	○	◎	◎
2. Facilitation of Cooperation toward the Development of AI Networking	○	◎	○	◎
3. Securing of Competitive Ecosystem	◎	◎	△	○
4. Challenges for Promotion of Economic Development and Innovation	○	◎	△	○
5. Setting Evaluation Indices on Impact of Development of AI Networking and Richness- and Happiness-related Indices	○	◎	◎	○
6. Protection of Users	◎	◎	◎	○
7. Ensuring Security for the AI Networking	○	○	△	◎
8. Institutional Issues relating to Privacy and Personal Data	◎	○	○	○
9. Institutional Issues relating to Content	◎	◎	○	○
10. Study of Basic Rules of Society	◎	○	○	○
11. Creating and Sharing Risk Scenarios	◎	△	○	◎
12. Accelerated Advancement of Information and Communications Infrastructure	○	○	△	◎
13. Prevention of the Formation of AI Network Divides	○	◎	○	○
14. Issues related to Ideal State of Human Existence	○	○	◎	○
15. Fostering of AI Network System Literacy	△	△	◎	◎
16. Personnel Training for the AI Networking	○	◎	○	◎
17. Improvements in Working Environments in Response to AI Networking	◎	◎	○	△
18. Establishment of a Safety Net	○	◎	○	△
19. Contribution to Human Happiness through the Resolution of Global Issues	◎	◎	◎	○
20. Approach to Governance of the AI Network Systems	◎	○	◎	○

* A strong relationship, moderate relationship, and weak relationship between each issue and region are shown by ◎, ○, and △, respectively.

11. Creating and Sharing Risk Scenarios

- **<u>Creating scenarios of various risks</u>** assuming the scenes of the utilization and application of AI network systems.
- **<u>Promotion of countermeasures</u>** based on scenarios against risks.
  - ➢ Risk assessment (Time of occurrence, occurrence probability, scale of damage etc.)
  - ➢ Risk management (risk prevention, operation stoppages and disconnection from networks in response to incidents, implementation of improvements, etc.)
  - ➢ Risk communication (e.g., scenarios shared by each stakeholder in society).
- **<u>Ongoing reviews of scenarios</u>** in accordance with the development of AI networking.
- Study on the ideal state of the **<u>government's initiatives</u>** with consideration of scenario.

Detail of Future Challenges (Extract)

20. Approach to Governance of the AI Network System

- Study on the **role sharing of hard laws** (e.g., administrative regulations and criminal regulations) **and soft laws** (e.g., agreements between stakeholders and forum standards) for the governance of AI network systems.
- Study on the ideal state of **consensus building among stakeholders** on AI network systems.
  - ➢ Study on the ideal state of the **process design of consensus building** among stakeholders.
  - ➢ Study on the ideal state of **communication between experts and non-experts**.
- Study on the ideal state of **opportunities to participate in the process of international rulemaking** on AI network systems and **maintenance of the transparency** of the process.
- **Formation of opportunities for international discussions** about issues concerning the governance of the AI network systems such as formulation of "AI R&D Guidelines".
  - ➢ Formation of **opportunities for domestic discussions** in preparation for international discussions.
  - ➢ **Promotion of research and study** on the ideal state of the governance of AI network systems.

- Remember the history of the internet
  - ➢ We can learn the deployment of new technology to our society.
    e.g. Connectivity -> Web -> Broadband -> Mobile -> IoT
  - ➢ As a result, we concern today on information security and privacy.

- Understand the difference
  - ➢ Is AI a next step from latest migration like IoT?
  - ➢ AI will become the networked system to collaborate each other.
  - ➢ "Unpredictable technology" is a key to find the difference.

- Find the reasonable transparency
  - ➢ Who can care about transparency?
  - ➢ Reasonable transparency should be a movement and/or framework that Users and Experts work together to clarify the ordinary and extra-ordinary condition.

- First of all, "AI Network System for Humankind"
  - ➤ AI Network System must be ruled by humankind as user themselves.
  - ➤ "User" includes not only "individual" but "company" and/or "community."
  - ➤ Users expect the availability of valid, affordable, controllable, safe and secured AI Network System.

- Never stop innovation to "AI Network System"
  - ➤ AI Network System can help us to create the "user-centric" society (if we want it.)
  - ➤ Japan prospects the potential of AI Network System due to facing the social problems.

- Think about ecosystem
  - ➤ What kind of ecosystem? Who takes the top?
  - ➤ The ecosystem should be developed with responsibility to "user."

Japan would like to talk on "AI Network System" with you!

Thank you for your attention.