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Cross-cultural (France and Japan) and Multidisciplinary Discussion on Artificial Intelligence and Robotics

Tendencies and Research Prospects

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Abstract

Artificial Intelligence (AI) is rapidly developing through a "Deep Learning model" that is based on a neural network and more powerful learning system than a traditional algorithm system. Our society is facing rapid technological changes that could lead to dramatic social impact in the economic, societal, educational and ethical landscape. In this context, the importance of multidisciplinary discussion and research in the field of Intelligent Systems (AI and Robot) is increasingly recognized. The present discussion paper aims to summarize the current state and research on Intelligent Systems and social impact and proposes multidisciplinary projects covering both engineering and social science studies. It presents three promising research topics that can provide us with a better understanding of Intelligent Systems and our attitude or relationship towards the technology: 1) international and national (France and Japan) initiatives with regard to the social impact of AI, 2) trust and acceptability in Intelligent Systems, and 3) Human-Machine Interaction.

Keywords

Acceptability, Artificial Intelligence, Autonomous car, Emotion, Employment, Human-machine interaction, Intelligent Systems, Kinetography Laban, Motion, Robotics, Social impact, Trust

Contents

1. Introduction

Artificial Intelligence (AI) is rapidly developing through new learning systems such as “Deep Learning model”, based on a neural network and learning data representation contrary to a task-specific algorithm. With this learning system, AI absorbs a large amount of information of the user, the environment, and the program data, and learns autonomously, so that it can identify people, emotions, conversations, and visual information, and help people make decisions. Deep Learning is a more powerful learning system than a traditional algorithm system, and therefore revolutionizes AI. Our society is facing rapid technological changes that could lead to dramatic social impact in the economic, societal, educational and ethical landscape.

In this context, the importance of multidisciplinary discussion and research in the field of Intelligent Systems (AI and Robot) is increasingly recognized. Firstly, the present discussion paper aims to summarize the current state and research on Intelligent Systems and social impact issue and secondly proposes multidisciplinary projects covering both engineering and social science studies interests. It presents three research topics as follows that can provide us with a better comprehension of AI and our attitude or relationship towards the technology.

1. International and national (France and Japan) initiatives with regard to the social impact of AI
2. Trust and acceptability in Intelligent Systems
3. Human-Machine Interaction

The first topic deals with current discussions and actions related to AI and social impact issues. This section aims to summarize the key information about governmental and academic initiatives on AI and the social impact issues at the international and national level underlying their positions or point of view. At the national level, I present particularly French and Japanese cases. The cross-cultural approach can raise a specific point of view on the issue in each society and permit us to understand their policy direction towards the technology.

Secondly, I discuss the question of trust and acceptability in Intelligent Systems (e.g. autonomous car) that could be the key concept to analyze human behaviour towards AI and robots. How do people trust automatic and intelligent machines? What research is to be conducted for developing “trustable” devices? What levels of intelligence and automation are necessary? Generally speaking, the trust and acceptability issues have been investigated in social psychology, human factor, management, and innovation studies. In this section, I propose a socio-ethnological approach to explore the question of trust and acceptability.

Finally, I propose a research project focusing on the interaction between Intelligent Systems (computer and robot) and users with an original method. The Human-Machine interaction study is one of the most important investments for the design and innovation of the future. The project aims to contribute to an improvement of the human-machine interaction providing smooth and easy access for users by using the concept of movement and emotion. The project suggests making a glossary of body movements respective to emotions, which I call the “Emotional Movement Dictionary”, by using Kinetography Laban which is a notation system for recording human movements, created by Rudolf Laban in 1928, developed in the context of dance. The goal of the Emotional Movement Dictionary is to help digital tool creators or roboticists to design social and friendly technological objects.

These three topics are not separated but linked through a cross-cultural and multi-disciplinary project. The first section provides overviews of tendencies in initiatives and directions related to AI issues in France and Japan and raises specific standpoints in each country. This cross-cultural approach is a useful way to understand the question in the second section: “trust and acceptability in the intelligent system”. Each society has its own experiences with technology, and then it could affect how people trust AI or Robot and accept to use it. The outcome of the second question would be applicable to improve the Human-Machine Interaction.

2. International and National (France and Japan) Initiatives with Regard to the Social Impact of AI

Many actions with regard to the social impact caused by AI are being undertaken involving engineers, researchers, and policymakers at a worldwide level. This section aims to clarify who (association, government, institute) takes initiatives and what topics they focus on.

At the national level, I present a general overview of French and Japanese initiatives regarding AI and its social impact focusing on their major discussion topics. The cross-cultural approach can raise a specific point of view on the issue in each society and permit us to understand their policy direction towards technology.

2.1. International initiatives dedicated to AI and the social impact

The discussion on the development of AI and its impact on the society is increasingly held on a variety of topics involving stakeholders of AI. The Institute of Electrical and Electronics Engineers (IEEE), which is a professional association and serves over 160 countries in the world, launched the “IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems” in April of 2016 (IEEE, 2016). The aim of the initiative is 1) to incorporate ethical aspects of human well-being in the design and manufacture of artificial and autonomous intelligent systems technologies, and 2) to ensure every stakeholder involved in the design and development of artificial and autonomous intelligent systems is educated, trained, and empowered to prioritize ethical consideration. The IEEE Global initiative’s activities consist of two outputs: 1) creating a report “Ethically Aligned Design: A Vision for Prioritizing Human Well-being with Autonomous and Intelligent Systems” and 2) recommending ideas for Standard Projects focused on prioritizing ethical consideration in artificial and intelligent systems.

In the private sector, “Partnership on Artificial Intelligence to Benefit People and Society” was founded in 2016, in collaboration with Amazon, DeepMind-Google, Facebook, IBM, Microsoft, and Apple. The purpose of the Partnership on AI is to: 1) develop and share practices in the research, development, testing, and fielding of AI technologies; 2) provide an open and inclusive platform for discussion and engagement; 3) advance public understanding; and 4) identify and foster aspirational efforts in AI for socially beneficial purposes.[1]

Furthermore, the OECD has undertaken several initiatives. In 2016, the OECD (2016) published a report entitled “Seizing the benefits of digitalization for growth and well-being”. The report clarifies the advantage of the digitalization and highlights points for making new policies in various areas such as taxation, competition, financial system, jobs and skills, innovation and so on. In October 2017, the OECD held an international conference on “AI: Intelligent Machines, Smart Policies” regarding current AI research, AI application, employment, security and privacy, policy landscape, responsibility and

1 Partnership on AI to benefit people and society. https://www.partnershiponai.org/#

liability, transparency and ethics.[2]

At the European level, the European Commission presented a series of measures aimed at putting artificial intelligence (AI) to serve European citizens and to boost Europe's competitiveness in this field in April 2018. It includes three topics: 1) to increase public and private investments in the research on AI, 2) to prepare for socio-economic changes, and 3) to establish an appropriate ethical and legal framework (European Commission, 2018). The Commission has decided to invest 1.5 billion euros for the period 2018 to 2020 in the framework of research program Horizon 2020. In order to prepare for socio-economic transformation which would be caused by AI, the Commission encourages Member States to modernize their education and training systems and support transitions on the labour market by building on the European Pillar of Social Rights. The Commission will present ethical guidelines for the development of AI by the end of 2018.

2.2. Governmental and academic initiatives on AI and the social impact in France

In France, several governmental initiatives on AI and social issues are being undertaken, and one of the most important discussion topics concerns the impact of AI and digitalization on employment. The Employment Orientation Board composed by government representatives, parliamentarians, and experts, produced a synthesis report targeted at the impact of the employment caused by automation and digitalization of employment in January 2017 (COE, 2017). The report forecasted the impact on employment as follows:

- Less than 10% of existing jobs are vulnerable to extinction in an automation and digitization context.
- Half of the existing jobs are likely to change significantly or very significantly in content.
- Technological progress would continue to favour skilled and highly qualified employment.

In the same moment, January 2017, the French Ministry of Economy and Finance launched a platform called "France IA"[3] in order to examine the current state of innovation and technologies, to forestall social impact, and to strengthen job training and research in the future involving policymakers, researchers and representatives from firms. As part of its activities, France IA published a report in March 2017 assessing the current state on AI issues and suggesting the strategy of the further development (Ministère de l'économie, 2017). The report stated that:

- In terms of the current state of development of AI in France, fundamental research on AI is well developed and essentially financed by public funds, but it should involve French major industrial groups in upstream research.
- A wide range of technologies exists, but is currently insufficiently exploited, and could be applied in the short term to a large number of sectors. The transfer of the technology developed in research to applied areas is essential.
- The continuous training and the cross-training between AI, Human and Social Sciences are indispensable to train engineers and stakeholders related to AI.

The France IA report also suggests that France must assert its leadership at the European level for AI development and become an attractive place for overseas talent and investors to develop company competitiveness (Ministère de l'économie, 2017). The report underlines the importance of

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2 OECD. Conference on Artificial Intelligence: "AI: Intelligent Machines, Smart Policies", 26-27 October 2017. http://www.oecd.org/going-digital/ai-intelligent-machines-smart-policies/

3 "Lancement de France I.A., stratégie nationale en intelligence artificielle," 2017.1.23. Ministère de l'Enseignement supérieur, de la Recherche et de l'Innovation. http://www.enseignementsup-recherche.gouv.fr/cid112129/lancement-de-france-i.a.-strategie-nationale-en-intelligence-artificielle.html

a long-term policy to support upstream research on AI and the transfer of research towards industry. Finally, the report makes recommendations on 5 topics: upstream research, training, application of technology, ecosystem development, and customer relationship.

The parliamentary body responsible for assessing scientific and technological choices (OPECST: *Office parlementaire d'évalutation des choix sceintifiques et technologiques*), published a report concerning the benefits and risks of AI, entitled "Toward a Controlled, Useful and Demystified Artificial Intelligence in March 2017 (De Ganay & Gillot, 2017). The goal of the report is to provide the state of current research in AI and to suggest the ethical, legal, economic, social and scientific challenges of AI. The report also deals with "Singularity", "NBIC convergence", and "transhumanism" issues in order to discuss questions of human dignity and ethics. Furthermore, France Stratégie, which is a national institution attached to the Prime Minister's office, reported on the economic and social impact of AI in 2017 (Hindi & Janin, 2017). The report mentioned both positive and negative effects of AI. The incorporation of AI into the economy would lead to significant competitiveness in the internal business process (e.g. management, logistic, customer, service) as well as productions (e.g. intelligent objects, driverless car) and services (e.g. banking, insurance). On the other hand, production by AI would be concentrated in the urban metropolis could lead to regional inequalities. Thus, the report alerts readers of the risk of economic dependence and sovereignty caused by AI.

In academia, INRIA (Institut National de Recherche en Informatique et en Automatique) published a report synthesizing their research and challenges related to AI, which included over 160 project teams (INRIA, 2016). Their research topics include the machine learning system, signal analysis (visual and speech), natural language processing, knowledge and semantic web, robotics and self-driving car, neuroscience and cognition, decision-making programming, music and smart environment. INRIA engages into science and technology transfer for societal welfare and aims at informing the society and governing bodies about the potentialities and risks of digital science and technologies. INRIA contributed to the creation of CERNA(*Commission de réflexion sur l'Éthique de la Recherche en sciences et technologies du Numérique d'Allistene*), founded in 2012, deploys many activities with regard to the ethical issues.[4] They consist of organizing seminars and conferences dedicated to ethics, coordinating communications between researchers, engineers and different stakeholders, and promoting research on AI.

2.3. Governmental and academic initiatives on AI and the social impact in Japan

In the same way as France, in Japan, governmental and academic initiatives dedicated to AI are increasing and a variety of topics are discussed. The Ministry of Internal Affairs and Communications has organized a regular seminar on the development of the information and communication network system using AI since 2016.[5] In April 2016, the "Strategic Council for AI Technology was launched under the direction of the Prime Minister in order to promote research and societal implementation of AI (Strategic Council for AI Technology, 2017). The Council, composed of the three research centres below, are affiliated with the Ministry of Internal Affairs and Communications, the Ministry of Education, and the Ministry of Economy:

1. Center for Information and Neural Networks (CiNet) and Universal Communication Research Institute (UCRI) of the National Institute of Information and Communications Technology (NICT)

4 CERNA. http://cerna-ethics-allistene.org/
5 Ministry of Internal Affairs and Communications. http://www.soumu.go.jp/main_sosiki/kenkyu/iict/

2. RIKEN Center for Advanced Intelligence Project (AIP) of the Institute of Physical and Chemical Research
3. Artificial Intelligence Research Center of the National Institute of Advanced Industrial Science and Technology (AIST)

In addition, the Council also involves other ministries such as the Cabinet Office, the Ministry of Health, the Ministry of Land, and the Ministry of Agriculture, who are planning projects on the application of AI, and the following research institutions: Japan Science and Technology Agency (JST), and the New Energy and Industrial Technology Development Organization (NEDO).

The Cabinet Office of Japan published a report on Ethical, Legal, Social Issues (ELSI) raised by the use of AI and socio-economic topics such as the change of work style and employment in 2017 (Cabinet Office, 2017). The Ministry of Economy also launched a discussion on the design of a policy strategy: “New Industrial Structure Vision” since August 2016 and released a report “Future Vision towards 2030s” for the purpose of identifying and overcoming society challenges by taking advantage of technological innovations, such as IoT, big data, AI, and robots (Ministry of Economy, 2017). The report mentions also the importance of the reorganization of industrial and employment structures, and personal training.

In academia, several organizations and committees have been founded since 2014. For instance, the Ethics Committee of the Japanese Society for Artificial Intelligence (JSAI) was established in December 2014 involving principally researchers, but also specialists of AI. The aim of the Ethics Committee of the JSAI consists of clarifying the state of current researches, anticipating potential risks and benefits due to AI, and discussing ethical issues for both AI designer and users.[6] The think tank named “Acceptability Intelligence with Responsibility (AIR)” has been set up by young social science researchers for the purpose of promoting a multidisciplinary discussion on ethical, legal and standard issues and the accountability of AI.[7] The Robot Low Study Group (*robotto ho kenkyu kai*), established in 2016 and composed of researchers, engineers and experts and students in law, provides a platform for sharing and exchanging knowledge and ideas on legislative framework for the use and development of robots. The AI & Society Meeting has been launched since 2015 for discussing the social impact of AI from philosophical, economic, legislative, political and sociological standpoints, gathering researchers, artists and public officers.[8]

2.4. Summary and future research

The previous section shows that the discussion on AI and its social impact is increasingly recognized and for this purpose, many institutions are deploying their activities at the worldwide level. At the national level, both in France and Japan, governmental and scientific institutions deploy their initiatives in order to identify social benefits and potential risks caused by AI. It is evident that there is a high expectation for AI as a factor of solving social problems (e.g. high unemployment rate in France, aging population in Japan) but also both countries consider a potential harm that could lead to a big societal change and affect human dignity.

Following this overview, a cross-cultural comparison can allow us to clarify differences in their initiatives, orientations, and discussion topics with regard to AI that vary according to the social value, representation, and problem that are specific to the society. Analyzing the initiatives of each society and their differences enables societies to establish their own standpoint on AI and their relationship with

6. Ethics Committee of the Japanese Society for Artificial Intelligence. http://ai-elsi.org/archives/514
7 Acceptability Intelligence with Responsibility. http://sig-air.org/
8 AI & Society Meeting. http://aisocietymeeting.wixsite.com/ethics-of-ai

the technology. For the future research, I plan to identify the differences and analyze these differences with linking with a specificity of each society (e.g. social problem, social value, or representation of the technology).

3. Trust and Acceptability in Intelligent Systems

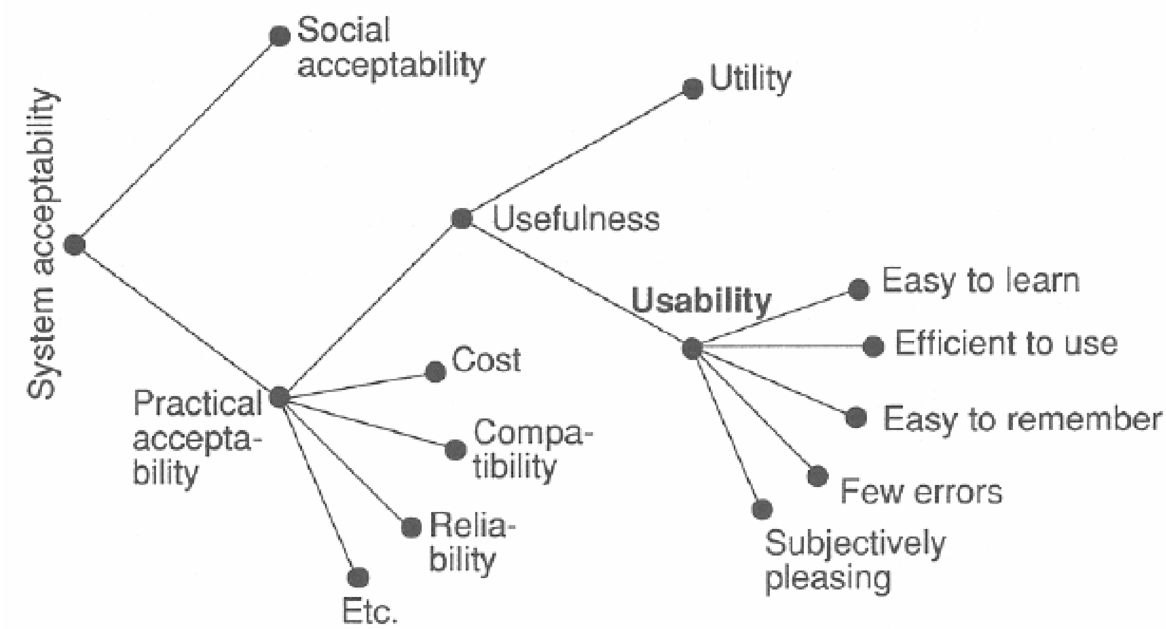
Technological device incorporated with AI can become more and more autonomous (e.g. driverless car). Faced with the situation where we have both expectation and worries about the use of AI, the question of trust and acceptability in Intelligent Systems is the key concept to analyze our behavior towards AI and robots. How can humans trust automatic and intelligent machines? What research is to be conducted for developing “trustable” devices? What levels of intelligence and automation are necessary?

Technological devices and intelligent objects are fully and increasingly integrated into our daily life, and its use becomes more and more indispensable. Ability to use such technological devices can affect professional performance, but also social ties. Openness to technology is naturally required. However, there also exists mistrust and fear towards technology (Boy, 2007). The question of trust and acceptability in technology is an important aspect to think about, when confronting the possibility of cohabitation with technology in our life. Trust and acceptability issues are investigated in social psychology, human factor, management, and innovation studies. In this section, I present an overview of current researches on the trust and acceptability in Intelligent Systems and propose a socio-ethnological approach to explore the question.

3.1. Researches on trust and acceptability in an individual or a machine

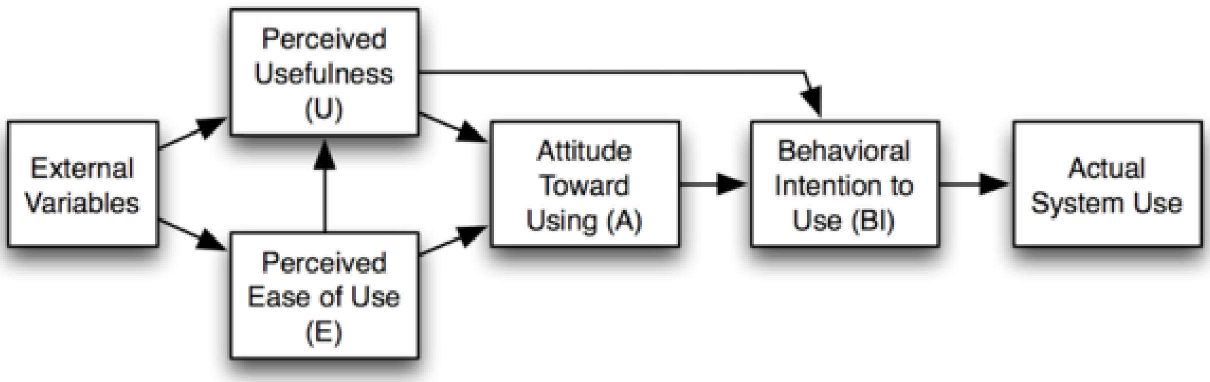
The question of trust in an individual is investigated in psychology, social psychology, and sociology. One of the most common definitions of the trust is the “willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party” (Mayer et al., 1995). Psychological studies distinguish types of trust such as general (Earle et al., 2007), social (Siegrist et al., 2001), and interpersonal (Bhattacharya et al., 1998). These works are applied to the trust research in Intelligent Systems. For instance, the study of Reevs and Naas (1996) shows that human act socially towards computers and apply social rules to technological devices. Regarding social trust, Siegrist et al. (2000) propose a “Salient Value Similarity” theory and argue that shared values determine social trust in individuals and institutions, and that people have a tendency to trust individuals who have values similar to them. In the line of the Salient Value Similarity model, Verberne et al. (2012) investigate trust and acceptability in smart systems in cars. They define trust as “an affective judgment of the user and trustworthiness as an attribute of the system”, and acceptability as “the judgment of potential acceptance before use”. The research demonstrates that the driver trusts a smart system (e.g. an Adaptive Cruise Control Systems) in the car, and that the acceptability of the system is high if the smart system shares a same goal as the driver. According to Nielsen (1993), acceptability is defined as “the question of whether the system is good enough to satisfy all the needs and requirements of the users and other potential stakeholders”. Nielsen proposed a model of acceptability that is devised social acceptability and practical acceptability (Fig.1).

Figure 1: Model of attributes of system acceptability (Nielsen, 1993)



Davis (1993) mentions the importance of performing user acceptance tests in the early design stage that reduces the risk of user rejection even if it is still unknown how well measures of acceptance done early in design reflect the level of user acceptance that would occur after a system is deployed. Davis developed a technology acceptance model that assesses how users come to accept and use a technology (Fig.2). In this model, “Perceived ease of use” is defined as the “degree to which a person believes that using a particular system would be free of effort”, affects “Perceived usefulness” that is defined as “the degree to which a person believes that using a particular system would enhance his or her job performance” (Davis, 1989).

Figure 2: The Technology Acceptance Model (Davis, 1993)



Regal et al. (2002), relying on the models produced by Nielsen, Davis, and others, distilled and summarised the key concepts to analyse user acceptance as follows.

- Usefulness: the system must serve some goal or purpose.
- Ease of use: often equated with “Usability”.
- Effectiveness: the system must do what it is designed to do.
- Affordability: are users willing to buy the system? Can they afford it? If they are, what are users willing to pay?
- Social acceptability: this is more global aspect of acceptability that recognises the broader social issues that are taken into account by users in judgement whether a technology is

acceptable.

Pasquier (2012) analyses that these models of acceptability do not consider social dimensions of the use, and proposes a psychosocial approach of the study of uses, in particular based on the concept of social acceptability.

3.2. A socio-ethnological approach toward trust and acceptability in the autonomous car

The trust and acceptability issues are investigated principally in social-psychology, human factor, management and innovation studies. I would like to explore a socio-ethnological approach to investigate the question of trust and acceptability. I propose a research topic on the trust in an autonomous/driverless/self-driving car in Japanese society focusing on Japanese particular relationship vis-à-vis a technological object.

The construction of autonomous cars is increasingly developing and these will be on sale in the near future. The autonomous car is broadly defined as a car capable of driving itself in real traffic without human intervention. The Japanese government (Ministry of Land, 2013) adapts the criteria of an autonomous car defined by the National Highway Traffic Safety Administration (NHTSA, 2013) of the United States (Fig.3). In Japan, cars up to level 2 are already on the market. The Japanese government supports the sale of the level 3 and 4 cars by 2020. Japanese automobile companies such as Toyota, Nissan, and Honda have also announced the sale of autonomous cars.9 10

Figure 3: NHTSA's definition of self-driving vehicle (NHTSA, 2013)

Level	Definition
Level 0: No-Automation	The driver is in complete and sole control of the primary vehicle controls – brake, steering, throttle, and motive power – at all times.
Level 1: Function-specific Automation	Automation at this level involves one or more specific control functions. Examples include electronic stability control or pre-charged brakes, where the vehicle automatically assists with braking to enable the driver to regain control of the vehicle or stop faster than possible by acting alone.
Level 2: Combined Function Automation	This level involves automation of at least two primary control functions designed to work in unison to relieve the driver of control of those functions. An example of combined functions enabling a Level 2 system is adaptive cruise control in combination with lane centering.
Level 3: Limited Self-Driving Automation	Vehicles at this level of automation enable the driver to cede full control of all safety-critical functions under certain traffic or environmental conditions, and in those conditions, to rely heavily on the vehicle to monitor changes requiring transition back to driver control. The driver is expected to be available for occasional control, but with sufficiently comfortable transition time. The Google car is an example of limited self-driving automation.
Level 4: Full Self-Driving Automation	The vehicle is designed to perform all safety-critical driving functions and monitor roadway conditions for an entire trip. Such a design anticipates that the driver will provide destination or navigation input, but is not expected to be available for control at any time during the trip. This includes both occupied and unoccupied vehicles.

9. Nihon Keizai Shinbun. Nissan, jidou untensha 20 nenmadeni hatubai, sishakushakoukai [Trad. Nissan presents a prototype of self-driving car, and releases self-driving car by 2020] 2013.8.28. http://www.nikkei.com/article/DGXNASGM28014_Y3A820C1MM0000/

10. Nihon Keizai Shinbun. Jidouunten, kokunai 3sha desorou. Honda ga hatsukoukai [Trad. Three companies prepare a release of a self driving car. Honda presents their car.] 2013.10.15 http://www.nikkei.com/article/DGXNASDD150PB_V11C13A0TJ0000/

The autonomous car would allow a driver to do anything other than driving during a trip, reduce driving worries such as a fatigue, and certainly provide us with more road security. However, when a driver chooses an autonomous/self-driving mode of his or her car, doesn't the driver have a certain hesitation to go through it even if he or she knows security system equipped in a car against all kinds of predictable potential danger? At the moment when a driver decides to entrust his control and responsibility to the technological system, the role of trust in technological system should be important. Some scientific studies (Waytz et al., 2014; Koo et al., 2014) focus on the role of the trust and investigate which factors can lead to trusting autonomous cars. The discussion of the trust in technology is an important factor for not only developing the technology system but also understanding our behaviour towards the technology. Here are some questions to deal with the question of trust: How do people trust automatic and intelligent machines? What research is to be conducted for developing "trustable" devices? What levels of intelligence and automation are necessary?

3.3. Technological development and relation to an object in Japan - Techno Animism

Before investigating the issue of trust in the autonomous car, more generally, I would like to focus on the Japanese relationship with the technological object, especially in robotics. At a worldwide level, Japan shows their outstanding development in robotics. For instance, in 2016, Japan was part of 5 major robotics markets: in China, the Republic of Korea, the US and Germany (IFR, 2017). Japan's robot sales reached its highest level; about 38.000 units since 2006 (IFR, 2017). We can observe not only industrial development, but also a lot of creation of technological and imaginary devices (e.g. shippo 11) (Nakazawa, 1997) in Japan.

Regarding this phenomenon vis-à-vis the technology, that is to say, the high industrial development, the designing of innovative objects, large use of technological devices, etc., the following questions would be often raised by Europeans: why do the Japanese have such an ease of designing technological objects, and how do they manage to incorporate and make it accessible to people so easily? A common hypothesis concerning the above questions, and shared among the European and the Japanese, is that the Japanese cosmogony and religion such as animism, Shinto and Buddhism have influenced the relationship between humans and artifacts (Mori, 1981; Yoshida et al., 1985; Kitano, 2007; Allison, 2008), which is not applicable to European culture. In the Japanese tradition, there is an animistic belief that an object has a soul. In this belief, the distinction between living being and object could be blurred, and the object is considered as a part of a living, so there is no difference or no boundary between humans and objects (Maison de la Culture du Japon, 2003; Yoshida, 1985). We can consider that Japanese share a certain affinity with their objects. On the other hand, in European traditional belief, the creation of an object similar to a human is considered dangerous because the creature could revolt against its creator. For instance, the myth of the Jew "Golem" describes exactly this narrative outline of the antagonism between creator and creature (Munier, 2013). On the basis of this idea, it might be difficult to build trust between human and object. This belief implicitly deployed in European society could restrain the development of the new creation, especially a humanoid robot. Okuno (2002), a Japanese anthropologist, refers to a belief in the existence of the soul in technological objects in Japan. This concept allows us to explain the Japanese attitude towards intelligent objects such as mobile phones and computers as more than a simple tool, and as personified or humanized objects.

11. It is a kind of Neurowear, a robotic tail that detects a mood and moves according to emotions. http://www.gizmodo.fr/2012/09/25/queue-robotique-exprimer-joie-neurowear.html

3.4. Summary and future research

This section presented an overview of research about the trust and acceptability in Intelligent Systems developed in social psychology, management and innovation studies. From these, I proposed a socio-ethnological approach to investigate the question of trust and acceptability in the case of autonomous cars. Before getting into the trust and acceptability of the use of autonomous cars, I referred to the particular relationship of the Japanese with regard to a robot. The proposed project focuses on cultural factors and traditional contexts that can influence the construction of trust in a technological object. It aims to consider religion, belief, or social representation and values shared in a society as a factor of the trust and acceptability in Intelligent Systems. As I mentioned above, this hypothesis is shared among researchers. For future research, it will be necessary to use an appropriate method for validating the hypothesis. In addition to the approaches of social psychology or innovation study, the socio-ethnological approach provides another viewpoint for studying the question of trust and acceptability. This approach is also useful to apply to the study of the use and the development of the autonomous car that would be soon on sale. This socio-ethnological approach can be complementary to another disciplinary approach. It can provide the key information specific to a certain culture and contribute to our understanding on the impact of the use of the autonomous car.

4. Human-Machine Interaction

Human-Machine interaction is a study of the interaction between humans and machines, and refers to principally, Human-Computer Interaction and Human-Robot Interaction. Human-Computer Interaction (HCI) is a field of study whose purpose is to understand and to improve our interaction with computer-based technologies (Kiesler & Hinds, 2004). The research investigates also usefulness, usability, acceptability, and technology's social impact including the risks of its use. Human-Computer Interaction is spread across a variety of disciplines: engineering, computer sciences, human factor, design, psychology, sociology, anthropology, communication and so on. Its application area includes mobile devices, Web and Internet services, games and network systems (Kiesler & Hinds, 2004). Human-Robot Interaction (HRI) is dedicated to investigating interaction and communication between human and robot equipped with Artificial Intelligence, speech and visual recognition and capacity of motion generation and identification. Its application area includes security, education, entertainment, health and elder care.

4.1. Aims and problems of Human-Robot Interaction

Multidisciplinary research on HRI started to emerge in the mid-1990's and early years of 2000 (Goodrich & Schultz, 2007). The aim of HRI interaction is to understand and shape the interaction between humans and robots. These works are multidisciplinary in nature and involve cognitive science, linguist, psychology, engineering, mathematics, computer science and human factors engineering and design.

There are two mains ways of interaction and communication between a human and a robot (Goodrich & Schultz, 2007).

1. Remote interaction - The human and the robot are not co-located and are separated spatially or even temporally
2. Proximate interaction - The humans and the robots are co-located

And five essential points to be focused for resolving a problem of HRI are defined as follows by

Goodrich & Schultz (2007).

1. Level and behaviour of autonomy:

To what degree can the robot act on its own accord? The question of autonomy is a means of supporting productive interaction.

2. Nature of information exchange:

The manner in which the information is exchanged between the human and the robot. It includes two dimensions of the communication medium (e.g. visual display, gestures, speech, physical interaction) and the format of the communication (e.g.).

3. Structure of the team. In case of multiple actors in the interaction:

The robot can be managed by more than one person and an extra agent could take action in the interaction between the human and the robot. It also concerns a question of organisation in a team, for instance: who has the authority to make decisions and to give instructions or commands to the robot? How conflicts are resolved?

4. Adaptation, learning, and training of people and the robot:

The robot adaptation and learning are a key element of long-term interaction in order to design efficient behaviour of the robot. On the other hand, it is also important to train HRI scientist, designers, and users in appropriate manner in a variety of application areas (e.g. search and rescue, military and police, social and educational application)

5. Shape of the task:

How should the task be done when the new technology is introduced?

Yonezawa (2018) distinguishes two research approaches in Human-Agent (machine and robot) Interaction: social and body approaches. A social approach is oriented to analyse a human psychological mechanism to recognize another person (e.g. person's opinion or will) during the interaction. A body approach consists of analysing human bodily expression that contains information of his internal state (e.g. emotion) and contextual situation as a tool of interaction and communication. It also consists of studying an agent interface able to express its "emotion" by using bodily expression such as a facial expression. Yonezawa (2018) emphasises the importance of bodily communication skills of the agent in order to improve a social interaction between a human and a robot and to make robot acceptable in the society.

4.2. Research proposal for Human-Computer/Robot Interaction

I propose a research project focusing on the interaction between the digital tool (computer and robot) and users with an innovative and original method to enhance this interaction. The project aims to contribute to the development and improvement of the interaction between human and digital and technological tools, such as computers and robots in order to provide a smooth and easy access for users. The project suggests making a glossary of movement respective to the emotions, which I call "Emotional Movement Dictionary", by using Kinetography Laban. The Emotional Movement Dictionary helps digital tool creators or robotic scientists to design social and friendly technological objects by using the concept of movement and emotion.

4.2.1. The use of emotion in Human Robot Interaction research

The role of emotion is considered an important element in Human and Robot interaction for improving an interaction and establishing a social relationship between human and robot. A variety of research on emotion and HRI has been undertaken. In health and therapy applications, for the purpose of helping individual with social disorders such as autism, researchers have investigated the perception of emotion expressed by the robot such as facial expression (Raffard et al, 2016; Ghorbandaei Pour et al., 2018; Pioggia et al., 2007). The role of emotion is also used for making a robot more autonomous and human-like with artificial intelligence (Malfaz & Salichs, 2004). In this research field, an emotional factor is implemented into the robot so that it can arouse negative or positive emotion, then the robot can adapt itself in its environment and situation, react and report rapidly to a human (Canamero, 2003). Thus, the emotional factor helps robot to make decision and to become autonomous.

The question of emotional estimation is as important as emotional recognition. How accurately can the robot detect and estimate human emotion in cases where an individual hides his emotion or has a less expressive character? Estimating human emotion is frequently based on observed and expressed information such as facial expression, gestures, eye-gazing direction, and behavior. Sometimes these elements are not suitable for estimating emotion because that an individual does not express himself in an observable and obvious manner. To resolve this kind of problem, researchers focus on more biological information (e.g. brain wave and heat rate) than expressed information (e.g. facial expression) for estimating human emotion (Ikeda, 2017).

4.2.2. The role of emotion is to build smooth and easy interactions: "friendly relationship"

Emotion is usually defined by a brain process system such as a chemical reaction in the brain to detect a feeling of appraisal and some responses (Kagan, 2007). I am particularly interested in the mental states associated with reactions such as anger, fear, sadness, joy etc. The Emotional Movement Dictionary project is based on the assumption that emotion plays an important role in building social interaction. Imagine a "friendly relationship" which allows smooth and easy usage and increases interactivity in both HCI and HRI cases.

Emotion is considered one of the communication signals for selected instances in the course of evolution (Kagan, 2007). Emotions help to regulate a social relationship. Anger for example, influences or intimidates others to do something you wish them to do; it triggers an individual to attack or defend and spaces the participants in a conflict (Plutchik, 2001). In Human Robot Interaction, there are many researches which deal with robot and emotion. The current research investigates 1) how the robot expresses emotion and 2) how the robot can recognize human emotion. Generally speaking, the goal of the first question is to create a human-like robot that is able to express like a human, as the robot is then supposed to be accepted easily or comfortably by humans (Sharma, 2013; Burton et al. 2016; Shibata & Inooka, 1998). The goal of the second is to make a robot that is able to recognize human state or emotion by detecting and interpreting human movement (Nakata, 2002). A recent study on human-robot relationship concludes that robots' empathic behavior towards humans arouses their positive opinion on robots and enables them to establish long-term and friendly relationship with robots (Pereira et al., 2010). Another research on human-robot interaction demonstrates the importance in the role of affect (e.g. a robot generates an affect and shows it to human) in order to improve their interactions and task performance (Scheutz et al., 2006).

Hence, I believe there is importance in the role of emotion in building better interactions between humans and objects. The project suggests that if artificial and intelligent objects "show their emotions" to users, then these objects will capture users attention, and the interaction would be more sociable. If users can feel a sense of affection, affinity, and more attention towards their artificial objects, it seems in a way, that the understanding capacity and urge to practice the facility will be enhanced in the users, which would permit smooth and easy use. This approach responds to the second criterion: "nature of information exchange" of Goodrich & Schultz (2007) which I mentioned above. The EMD project employs affect-solution (requires human attention to the object), which relies on emotion as a tool to establish a social relationship and not technical-solution (making high tech objects for users).

4.2.3. Why emotional movement?

Emotion would be transmitted in many different ways, through facial expression, utterances, behaviors, gestures, body movements and so on. I would particularly focus on the importance of movement to capture attention. Movement has an important signification like the emotion in the human's evolution as it is crucial in the detection of animated entities in our visual field for survival. Psychological studies show us that a moving object captures visually more attention than unanimated objects (Pratt et al., 2010). Other scientific experiences show that the sudden movement of objects captures strong attention compared to unanimated colored objects (Franconeri & Simons, 2003). Movement is also useful factor because it would be applicable to artificial agents in any form: 3D or 2D animation, graphical interface, and robots with human and non-humanlike shape. My attempt is not an anthropomorophization of artificial agents, but to design an expressive object by its movement that would capture user's attention.

4.2.4. What is the Emotional Movement Dictionary (EMD)?

The Emotional Movement Dictionary is a glossary of movements according to different emotions. As movement takes place in space and time, it will be coded in time and space level, without determining a part of the body, that is to say, each emotion is translated by the scale of time (variation, rhythm) and space (direction and level). Thereby the dictionary will contain spatio-temporal representation in terms of emotions without describing the body part. For example, let's suppose that "anger" would be expressed as repetitive (time scale) movements going down (direction scale) intensely in short distance (direction scale), then suddenly (time scale) and in a movement expanding in divers directions (direction scale).

The EMD has a common idea as with some previous studies on human gestures (Poggi, 2002) and emotional facial expression (Ekman & Friesen, 1978; Kendon, 1990), in which the project seeks coded human dynamics. However the content of the dictionary will not be a descriptive list of behavioral patterns with which the previous studies have employed. The dictionary will be represented and detailed by a notation system: Kinetography Laban, which is a notation system for recording human movements, created by Rudolf Laban in 1928, developed in the context of dance. Kinetography Laban permits to describe observable human movements, not only patterns of action (ex. classical dance) but also any kind of movements (ex. dynamic movement, posture, relationship with others or objects, movement of a group), in three aspects: time, space, and body with using abstract symbols. Kinetography Laban allows transcribing human dynamics, that is, human movements in geometrical symbols and to encode human dynamic movement. Once human dynamics are translated by the notation system, Laban's coding of movement would be transposed to a programming language, in order to determine an algorithm.

4.3. Summary and application of the proposed research

In this section, I proposed a research project: Emotional Movement Dictionary for the purpose of enhancing the interaction between human and machine (computer and robot) by using of the concept of body motion and emotion. I also proposed to use Kinetography Laban for encoding movement into spatio-temporal representation. There are existing studies of the application of Kinetography Laban to robotics, specifically on human and robot motion as a multidisciplinary project between robotics and dance (Laumond & Abe, 2016).

The usefulness of the EMD project is expected both in HCI an HRI. The EMD is a reference to programming parameters to the design graphic interface, virtual characters of 3D and 2D animation, and intelligent machine, in order to increase interactivity between human and machine, virtual character or object. The EMD will be useful for the following fields:

1. In the study of Human-Computer Interaction (HCI). The EMD helps to design user interface to increase interactivity with a computer.
2. In Robotics. The EMD helps in the programming of robots, which is human or non-human shape like in order to build a social relationship between human and robot.
3. In design for a creation of 2D and 3D animation. The EMD contributes to the creation of animated characters, especially non-human shape like characters, which would become more popular in the fields of 2D and 3D animations in film and video games.

Nowadays, the design concept will often rely on intuitive learning. I believe that users' active attention towards objects is an important key to use technological objects, which is becoming more complex. The Emotional Movement Dictionary helps to urge users to carry more attention towards the objects that is important and necessary in order to establish harmonious living with objects in the future. I believe that this environment where human can trust in use of the robot and use it easily and safely is the key point towards our future life. It is an innovative and ambitious project in terms of new forms of communication and interaction. Multidisciplinary collaboration is indispensable and the key to complete the project.

5. Conclusion

This discussion paper presents three research topics in the subject of Artificial Intelligence and Robotics. I provide a research prospect in each topic. The first section provides an overview of the current discussion on AI and its social impact undertaking at the international and national levels. Regarding research prospects, I emphasized on the importance of a cross-cultural approach for clarifying differences in their initiatives, orientations, and discussion topics with regard to AI so as to provide specific standpoints on the technology in each society. The second section provides a state of current research on the trust and acceptability in Intelligent Systems and proposes a socio-ethnological approach for studying the question of the trust and acceptability, especially in the case of the autonomous car in Japan. Each society has its own experience with technology, and could affect their attitudes (trust, mistrust, accept to use or not) towards the technological object. In this section, I discuss the usefulness of socio-cultural factors such as religion, beliefs, social representation and values for investigating the question of trust and acceptability. Finally, the third section presents an innovative and challenging project called Emotional Movement Dictionary by using Kinethography Laban for the purpose of enhancing the interaction between human and machine.

These three topics are not separated but linked as cross-cultural and multidisciplinary projects. Cross-cultural and multi-disciplinary discussion is a key to investigating the Intelligent Systems and its impact on human society and life, and to understanding human attitude towards the technology. To developing research in this direction, the collaboration between engineering and social sciences, especially science and technology studies, anthology of techniques, and the sociology of trust should become indispensable.

6. References

Allison A. (2008). La culture populaire japonaise et l'imaginaire global. Critique international N°38.

Bhattacharya, R., Divinney, T. M., & Pillutla, M. M. (1998). A formal model of trust based on outcomes. Academy of Management Review, 23(3), 459-472.

Boy, D. (2007). Pourquoi avons-nous peur de la technologie ? Paris : Presses de Sciences Po (P.F.N.S.P.), Collection Académique.

Burton, S.J., Samadani, A. A., Gorbet, R. & Kulić, D. (2016). Laban Movement Analysis and Affective Movement Generation for Robots and Other Near-Living Creatures. In Laumond, J.-P. & Abe, N. (Eds). Dance Notations and Robot Motion, Springer Tracts in Advanced Robotics 111, Switzerland: Springer, pp.25-48.

Cabinet Office, Government of Japan. (2017). Advisory Board on Artificial Intelligence and Human Society, Report on Artificial Intelligence and Human Society Unofficial translation. 2017.3.27. http://www8.cao.go.jp/cstp/tyousakai/ai/summary/aisociety_en.pdf

Canamero, L. D. (2003). Designing emotions for activity selection in autonomous agents. In Trappl, R., Petta P., & Payr, S. Emotions in Humans and Artifacts. Cambridge, Massachusetts: The MIT Press, pp.115-148.

Conseil d'orientation pour l'emploi. (2017). Automatisation, numérisation et emploi Tome 1: les impacts sur le volume, la structure et la localisation de l'emploi (Synthèse). http://www.coe.gouv.fr/IMG/pdf/COE_170110_Synthese_du_rapport_Automatisation_numerisation_et_emploi_Tome_1.pdf

Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. Management Information Systems Quarterly, 13(3), September 1989, pp. 319-340.

Davis, F. D. (1993). User acceptance of information technology: system characteristics, user perceptions and behavioral impacts. International Journal of Man-Machine Studies, March 1993, 38(3), pp.475-487.

De Ganay, C. & Gillot, D. (2017). Pour une intelligence artificielle maîtrisée, utile et démystifiée - Tome I. L'Office parlementaire d'évaluation des choix scientifiques et technologiques. 2017.3.15. http://www.senat.fr/rap/r16-464-1/r16-464-11.pdf

Earle, T. C., Siegrist, M., & Gutscher, H. (2007). Trust, Risk Perception, and the TCC Model of Cooperation. In Siegrist, M., Earle, T.C. & Gutscher, H. (Eds.). Trust in Cooperative Risk Management: Uncertainty and Scepticism in the Public Mind. pp.1-49. London: Earthscan.

Ekman, P. & Friesen, W. (1978). Facial Action Coding System. Palo Alto, CA: Consulting Psychologist Press, Inc.

European Commission (2018). Artificial intelligence: Commission outlines a European approach to boost investment and set ethical guidelines. 2018.4.25. http://europa.eu/rapid/press-release_IP-18-3362_en.htm

Franconeri, S. L., & Simons, D. J. (2003). Moving and looming stimuli capture attention.

Perception & Psychophysics, 65, pp.999-1010.

Ghorbandaei Pour, A., Taheri, A., Alemi, M., & Meghdari, A. (2018). Human-Robot Facial Expression Reciprocal Interaction Platform: Case Studies on Children with Autism. International Journal of Social Robotics, 10(2), pp.179-198.

Goodrich, M. A., & Schultz, A. C. (2007), Human-Robot Interaction: A Survey. Foundations and Trends in Human - Computer Interaction, 1(3), pp.203–275.

Hindi, R. & Janin, L. (2017). Anticipating the Economic and Social Impacts of Artificial Intelligence, National Strategy on Artificial Intelligence, report by working group 3.2. March 2017, Conseil National du Numérique, France Stratégie.

IEEE. (2016). The IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems. http://standards.ieee.org/develop/indconn/ec/ec_about_us.pdf

Ikeda, Y., Horie, R., & Sugaya, M. (2017). Estimating Emotion with Biological Information for Robot Interaction. International Conference on Knowledge Based and Intelligent Information and Engineering Systems, KES2017, September 6-8, Marseille, France.

INRIA. (2016). Artificial Intelligence, Current challenges and Inria's engagement. White paper.

International Federation of Robotics. (2017). World Robotics 2017 Industrial Robots.

Kagan, J. (2007). What is emotion? : history, measures, and meanings. New Haven, London: Yael University Press.

Kendon, A. (1990). Conducting interaction: Patterns of behavior in focused encounters. Cambridge: Cambridge University Press.

Kiesler, S., & Hinds, P. (2004). Introduction to This Special Issue on Human-Robot Interaction. Human - Computer Interaction, 19(1-2), pp.1-8.

Kitano, N. (2007). Animism, Rinri, Modernization; the Base of Japanese Robotics. Tokyo: Waseda University.

Koo, J., Kwac, J., Ju, W., Steinert, M., Leifer, L., & Nass, C. (2014). Why did my car just do that? Explaining semi-autonomous driving actions to improve driver understanding, trust, and performance. International Journal on Interactive Design and Manufacturing (IJIDeM), Springer, April 2014, pp.1-7.

La Maision de la Culture du Japon à Paris. (2003). Fantaisies cybernétiques. Fondation du Japon.

Laumond, J. P. & Abe, N. (Eds.). (2016). Dance Notations and Robot Motion, Springer Tracts in Advanced Robotics 111, Switzerland: Springer.

Malfaz, M., & Salichs, M. A. (2004). A new architecture for autonomous robots base on émotions. 5th IFAC/EURON Symposium on Intelligent Autonomous Vehicles Instituto Superior Técnico, July 5-7, Lisboa, Portugal.

Mayer, R. C., Davis, J. H., & Schoorman, F. D. (1995). An integrative model of organizational trust. Academy of Management Review, 20, pp.709-734.

Ministère de l'économie et des finances. (2017). France Intelligence Artificielle - Rapport de synthèse. https://www.economie.gouv.fr/files/files/PDF/2017/Rapport_synthese_France_IA_.pdf

Ministry of Economy, Trade, Industry. (2017). Future Version 2030s. 2017.5.30. http://www.meti.go.jp/press/2017/05/20170530007/20170530007-2.pdf

Ministry of Land, Infrastructure, Transport and Tourism. (2013). Auto pairotto sistemu ni kansuru kentoukai. Dai gokai haifusiryou. [Trad. 5th study group on the self-driving system]

Mori, M. (1981). The Buddha in the Robot. A Robot Engineer's Thoughts on Science and Religion. Tokyo: Kosei Pub. Co.

Munier, B. (Eds.). (2013) Technocorps: La sociologie du corps à l'épreuve des nouvelles technologies, Paris: Les Editions Nouvelles François Bourin.

Nakata, T., Mori, T. & Sato, T. (2002). Analysis of Impression of Robot Bodily Expression. Journal of Robotics and Mechatronics, vol.14, pp.27-36.

Nakazawa, S. (1997). Poketto no naka no yasei [Trad. A wild world in a pocket]. Tokyo: Iwanami shoten.

National Highway Traffic Safety Administration. (2013). Preliminary Statement of Policy Concerning Automated Vehicles.

Nielsen, J. (1993). Usability engineering. Boston: Academic Press.

OECD. (2016). Seizing the benefits of digitalisation for growth and well-being. DSTI/IND/STP/ICCP/CP(2016)3/REV1

Okuno, T., (2002). Ningen, doubutsu, kikai-technoanimisme [Trad. Humain, animal, machine-technoanimism], Tokyo: Kadogawa shoten.

Pasquier, H. (2012). Définir l'acceptabilité sociale dans les modèles d'usage. Vers l'introduction de la valeur sociale dans la prédiction du comportement d'utilisation. Thesis, University of Rennes 2.

Pereira, A., Leite, I., Mascarenhas, S., Martinho, C., & Paiva, A. (2010). Using empathy to improve human-robot Relationship. Human-Robot Personal Relationships, HRPR 2010, Springer, pp.130-138.

Pioggia, G., Sica, M. L., Ferro, M., Igliozzi, R., Muratori, F., Ahluwalia A., & De Rossi, D. (2007). Human-Robot Interaction in Autism: FACE, an Android-based Social Therapy. Robot and Human interactive Communication, RO-MAN 2007, The 16th IEEE International Symposium, August 26-29.

Plutchik, R. (2001). The nature of emotions. American scientist, 89(4), pp.344-350.

Poggi, I. (2002). Towards the alphabet and the lexicon of gesture, gaze and touch. In Bouissac, P. (Eds.). Virtual Symposium on Multimodality of Human Communication.

Pratt, J., Radulescu, P. V., Guo, R. M., & Abrams R. A. (2010). It's alive! animate motion captures visual attention. Psychological Science, Nov. 21(11), pp.1724-30.

Raffard, S., Bortolon, C., Khoramshahi, M., Salesse, R. N., Burca, M., Marin, L., Bardy, B. G., Billard, A., Macioce, V., & Capdevielle, D. (2016). Humanoid robots versus humans: How is emotional valence of facial expressions recognized by individuals with schizophrenia? An exploratory study, Schizophrenia Research, 176, pp.506–513.

Reeves, B., & Nass, C. (1996). The media equation: How people treat computers, television, and new media like real people and places. New York: Cambridge University Press.

Regan, M. A., Mitsopoulos, E., Haworth, N., & Young, K. (2002). Acceptability of in-vehicle intelligent transport systems to Victorian car drivers, Final Report. August 2002, Monash University Accident Research Centre.

Scheutz, M. Schermerhorn, P., & Kramer, J. (2006). The Utility of Affect Expression in Natural Language Interactions in Joint Human-Robot Tasks. HRI 2006 proceeding of the 1st ACM SIGCHI/SIGART conference on Human-robot interaction, New York, pp.226-233.

Sharma, M. (2013). Adapting the Laban Effort System to Design Affect-Communication Locomotion Path for a Flying Robot. MSc thesis, The University of Manitoba, Manitoba, Canada.

Shibata, S. & Inooka, H. (1998). Psychological evaluations of robot motions. International Journal of Industrial Ergonomics, vol.21, no6, pp.483-494.

Siegrist, M., Cvetkovich, G. T., & Gutscher, H. (2001). Shared values, social trust, and the perception of geographic cancer clusters. Risk Analysis, 21, pp.1047-1053.

Siegrist, M., Cvetkovich, G., & Roth, C. (2000). Salient value similarity, social trust, and risk/benefit perception. Risk Analysis, June 2000(3), pp.353-62.

Strategic Council for AI technology. (2017). Artificial Intelligence Technology Strategy. 2017.3.17. http://www.nedo.go.jp/content/100865202.pdf

Verberne, F. M. F., Ham, J., & Midden, C. J. H. (2012). Trust in Smart Systems: Sharing Driving Goals and Giving Information to Increase Trustworthiness and Acceptability of Smart Systems in Cars. Human Factors, October 2012, 54(5), pp.799-810.

Waytz, A., Heafner, J., & Epley, N. (2014). The mind in the machine: Anthropomorphism increases trust in an autonomous vehicle. Journal of Experimental Social Psychology, 52, May 2014, pp.113-117.

Yonezawa, T. (2018). Human Agent Interaction. In Ema A. (Eds.). Perspectives on Artificial Intelligence/Robotics and Work/Employment. National Diet Library, 2018.3.30, pp.22-25.

Yoshida, M., Tanaka, I., & Tsune, S. (Eds.). (1985). The culture of ANIMA - Supernature in Japanese Life. Hiroshima: Mazda Motor Corp.

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