02-03 Dec. 2019: Roundtables on the Ethics of Genome Editing and Artificial Intelligence

Paris, Unesco headquarters

These two roundtables were held for the second time at UNESCO after 2018, always under the authority of the UNESCO World Commission on the Ethics of Scientific Knowledge and Technology (COMEST), and with special funding from the Japan Ministry of Education, Culture, Sports, Science and Technology. Both roundtables were introduced by Nada Al-Nashif, Assistant Director General for the Human and Social Sciences Sector. Interestingly, no one represented the Natural Sciences Sector in the protocol, nor in the panelists or audience interventions.

The eight panelists offered good interdisciplinary diversity (as well as geographical and gender diversity), with senior academics in Medicine, Molecular Biology, Agricultural research, Philosophy, Law, Robotics, and Neurosciences. However, there were no engineers.

Roundtable 1 on the Ethics of Genome Editing, "Impact of Genome Editing on our Health and Environment"

The first session was moderated and chaired by Prof. Hervé Chneiweiss (CNRS, Chairperson of UNESCO International Bioethics Committee - IBC).

The first session focused on the ethics of genome editing.
Prof. Chneiweiss gave some basic context on genome editing:
- DNA editing in general has been an accessible technique for decades, but with unsatisfying accuracy and thus limited applications.
- A major change of context resulted from the emergence of the CRISPR/Ca9 technology (2012) that allows extremely accurate DNA cuts, and therefore accurate editing with limited off-targets effects (or none). Since 2012 6,000+ academic articles were published about this technique or from experiments or innovations that were made possible through it.
- UNESCO has already issued three declarations on the ethics of human genome, in 1997, 2003, and 2005 (*Universal Declaration on Bioethics and Human Rights,* adopted by the General Conference).

Prof. Sarah Chan (University of Edinburgh) talked about the question of long-time consequences of genome editing (HHGE, Human Heritable Genome Editing), either for research of therapy purposes (or both), especially for cancers which are mostly genetically inherited diseases as it results in "*editing the genome of humanity*". This implies making choices for humans yet to be borne. Although these matters should be taken into account, she pointed out that we should not mix ethical concerns and medical risks, i.e. treat them separately, and assessing the risk/benefit ratio as for any other medical act.

Prof. Kazuto Kato (Osaka University) gave a comprehensive picture of Japanese control and ethical assessment system for bioethics, this system being quite elaborated and functional, so it may serve as a model elsewhere.

In conclusion, Prof Chneiweiss insisted on the heterogeneity of ethical standards and procedures, and the need for discussion on these aspects, especially through the ARRIGE (Association for Responsible Research and Innovation in Genome Editing) that implies the World Health Organization and UNESCO through its Bioethics committee. Recent human genome editing experiments ("Crispr babies") have led to unexpected genetic mutation due to insufficient caution in experimental protocol[1].

The second session was focusing on the environmental impact of genome editing. Prof. Chneiweiss mentioned in introduction that genome editing for plants or animal is common practice nowadays, on lambs, cows, cabbage, oil… either to diminish risks or to raise food quality.

Dr. Francine Ntoumi, Director of the Congolese Foundation for Medical Research, presented the general context of medical genetics research in Africa and the difficulty of developing it, due to lack of coordination, funding, but more importantly, cultural difficulties. She took the example of the Target Malaria project in Burkina Faso, Ghana, Mali and Uganda, consisting in editing female mosquitoes genome (using CRISPR/Cas9) to diminish the population of the species responsible for spreading malaria. The first transgenic mosquitoes (made fluorescent for the purpose of identification) were released this year in Burkina Faso but this phase 1 of the program raised a lot of worryness in local communities, because they had not been appropriately advised[2].
The issue is huge, as malaria is the main public health challenge in Africa (in 2018: 219 M cases, 435,000 deaths, amongst them 61% of young children).
It is important to note that the gene-drive approach is probably the most suitable to fight the epidemy, as it is safe for humans and the environment, long-lasting, relatively inexpensive (compared to massive medical assistance to millions of people, or methods of physical, cultural or chemical control of mosquitoes).

Dr. Nicolas Rode offered complementary views on editing insects' genomes (as a general technique that is relevant for health projects as well as for food supply and culture protection) especially on two difficulties about which the technology control has to be improved: *reversibility* (to stop a gene-drive process by introducing a gene-drive brake) and *resistance* of the insects to the gene-drive (cases of a resistant chromosomes).
He also addressed the issue of combining species' genic control strategies with the need to protect biodiversity, and listed the basic rules to observe in order to design a sustainable framework for these research and innovations, namely:
- *To support public research, with both theoretical and experimental approaches, with no conflict of interests;*
- *Case-by-case assessment for research programs, helping to consider alternatives techniques;*
- *No perturbations of ecosystems functions.*

During the discussion, someone in the audience raised the issue of the illusions of solving social or political problems through biotechnologies and bioengineering. Prof. Chneiweiss noted that an obvious

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[1] See https://www.technologyreview.com/s/614764/chinas-crispr-babies-read-exclusive-excerpts-he-jiankui-paper/ and https://www.nature.com/articles/d41586-019-03032-2
[2] See https://www.reuters.com/article/us-burkina-malaria/scientists-release-sterile-mosquitoes-in-burkina-to-fight-malaria-idUSKBN1W310X

example that reaches quite a consensus amongst scientists is that a very easy task for genome editing would consist in changing people's color of eyes or skins: however, no one seriously believes that this would solve the issue of racism, discrimination or intolerance in any given society.

Roundtable 2 on the Ethics of Artificial Intelligence "Changing Relationship Between Artificial Intelligence and Humans"

As last year, the session was chaired by Prof. Verbeek (University of Twente, Chairperson of the COMEST).

The first session consisted in a dialogue between a philosopher (Paula Boddington, Cardiff University, author of *Towards a Code of Ethics for Artificial Intelligence*[3]) and a legal researcher (Vidushi Marda, Article 19, India[4]).

This session was rather similar to last year's roundtable, presenting reminders on the various basic aspects of what AI is and what kind of implications it has, mostly in decision making.

Classical issues of trolley-problem type (critical choices to be made between dramatic consequences, involving human's lives) were exposed, augmented versions of Turing-machine tests, as well as the issue of biases in machine-learning based decisions, because of the data available (that favorizes populations that are already privileged) .

Main notions to rely on are that:
- *AI takes many forms;*
- *AI is a tool, we decide how to use it;*
- *AI imply changes that are also an opportunity to reflect deeply on human values.*

A striking quotation by E. Snowden was shown: "*Nothing inspires arrogance like the time spent controlling machines that are incapable of criticism*".

The most interesting part was the discussion between the panelists, moderator and audience on how AI can assist with fighting hate and violent speeches/contents online, as this is an increasingly important matter for both governments and internet main companies.

A consensus is that, at its current state, machine learning technologies are unable to effectively find, analyse and report on such content, because cultural and political contexts are too complex systems to be properly learned through quantitative data (understanding whether a Facebook comment is hateful and incentive for violence is very different from learning how a particular car, animal or human face looks like or expresses: in the second case you just need a lot of data from which a machine can learn, in the first you need to correlate a certain context and a certain use of language, with many nuances in each language, as well as possible uses of irony, complexe uses of quotations, etc.).

Moreover, hate, for instance, is a very complex notion from a legal point of view, and may not be treated the same way in all regions of the world (insofar as only an oligopoly of global companies have sufficient means). Facebook AI's inability to "effectively monitor and remove hate speech" was demonstrated in the recent Myanmar case[5].

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[3] See https://futureoflife.org/2017/07/31/towards-a-code-of-ethics-in-artificial-intelligence/

[4] http://vidushimarda.com/

[5] See https://teacircleoxford.com/2018/11/06/facebook-in-myanmar-a-human-problem-that-ai-cant-solve/

The second session focused on interactions between humans and robots, mainly under the scope of social uses and empathy. Dr. Carmen Torras (Robotics Institute, Spain) presented some applied research projects in "assisted living facility" (room/apartment equipped with robotics material designed to interact with humans, help them dressing, cooking, etc.)[6].

The main issue addressed with these technologies is to ensure that robots interact with humans in a way that guarantee user's safety, so that they can modify the robot's behaviour if they feel unsafe.

The ethical and social implications are related to the kind of empathy to which such technologies can lead. While employed for teaching or taking care of old/disabled persons, robots assistant will partly take the place of humans in daily interactions with users, in such a way that users will start having feelings towards robots. Special care shall be taken about children exposed to robotics applications even when designed to only assist teachers.

Dr. Torras also presented the CM/IEEE Computer Science Curricula programme, that includes courses on *Ethics in Technology, Roboethics and Professional Ethics* in 18 knowledge areas, and quoted Barbara J. Grosz "*By making ethical reasoning a central element in the curriculum, students can learn to think not only about what technology they could create, but also whether they should create that technology*".

The second panelist, Dr. Emily Cross (University of Glasgow, leader scientist of the European Research Council project "Social Robots[7]") precisely studies from the neurosciences viewpoint what happens when human brain interacts with robots (vs. with humans). Her experiment notably shows that the human brain easily reacts as when confronted to human's pain when expressions of violent pain are repeatedly simulated on a robot.

She pointed out that "*Social robots, per se, are poised to dramatically change the industries and domains traditionally thought as strictly human, including education, healthcare, services, communication, and sex.*" (adding that this list is non-exhaustive).

A global conclusion arising from the discussion is that anthropomorphism can be very tricky when robots become "social", and should be manipulated carefully.

Another important point is that, as a matter of respect of human person, we should start making sure that one always knows whether he/she is interacting with a robot or a human (considering the example of Google assistant program, that autonomously makes phone calls without being detected as a robot voice). In any case, ethics of human-AI interaction need to be thoroughly studied as such, and debated amongst a wide, trans-disciplinary community of experts and scholars.

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[6] See http://www.iri.upc.edu/people/torras/videos.html

[7] http://www.so-bots.com/