GENETICS, ROBOTICS, LAW, PUNISHMENT

edited by

Debora Provolo - Silvio Riondato - Feridun Yenisey

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Genetics, robotics and crime prevention

Lorenzo Pasculli

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1. Introduction and definitions

Amongst the many fields of law affected by genetics and robotics there is also crime prevention.

I will consider here some of the current and the possible future employments of genetics and robotics in crime prevention and some of the issues they raise with special regard to the protection of fundamental individual rights and freedoms.

1.1. Crime prevention

First of all, it is necessary to clarify what I mean by «crime prevention», since it is a concept of almost unending elasticity[1].

«Crime prevention» may be intended either as an *end* or as a *means*[2]. In this paper with the expression «crime prevention» I will refer to the means of elimination or reduction of the causes of crime (and therefore of the risk of crime). In such a

[1] A. Crawford, *Crime, Prevention & Community Safety. Politics, Policies & Practices*, London, Longman, 1998, p. 7.

[2] Cf., *amplius*, L. Pasculli, *Dangerous Prevention. A General Theory of the Negative Measures of Global Crime Prevention*, Padova, forthcoming.

wide conception I include both the so-called positive and negative models of crime prevention:

1) the *positive model* consists of measures that expand, promote, improve the individual legal sphere (for instance: educational programmes, developmental crime prevention, psychological and social support, restorative justice, community policing, situational prevention etc.)

2) the *negative model*, instead, consists of measures compressing the individual legal sphere, and especially individual liberty, generally through the direct or indirect use of force (for instance: preventive detention; confiscation of property; asset freeze; civil and criminal forfeiture; repatriation of immigrants etc.)[3].

Due to its negative contents, the negative model poses several threats to fundamental rights and liberties, especially when negative measures are applied to merely «dangerous» subjects, before they commit any crime (pre-crime or *praeter delictum* measures).

1.2. Genetics

Genetics is the study of heredity in general and of genes in particular. Genetics forms one of the central pillars of biology and overlaps with many other areas such as agriculture, medicine, and biotechnology[4].

While *classical genetics* – which remains the foundation for all other areas in genetics – is concerned primarily with the method by which genetic traits are transmitted in plants and animals, genetics covers several areas of study, such as *cytogenetics* (the microscopic study of chromosomes), *microbial genetics* (the study of microorganisms), *molecular genetics* (the study of the molecular structure of DNA), *genomics* (the study of the structure, function, and evolutionary comparison of whole genomes), *population genetics* (the study of genes in populations of animals, plants, and microbes), *behaviour genetics* (the study of the influence of heredity on behaviour), etc.

As we will see, the two most relevant areas of genetics in crime prevention are *behavioural genetics* and *genomics* (which dominates also genetics research in general and which is also a useful way to explore the genetic factors involved in complex human traits such as behaviour).

[3] For a first outline on the several models of crime prevention, also in comparative and supranational/international perspective, see L. Pasculli, *Le misure di prevenzione del terrorismo e dei traffici criminosi internazionali*, Padova, Padova University Press, 2012, also for further references.

[4] Entry «Genetics», in *Encyclopædia Britannica. Encyclopædia Britannica Online*, Encyclopædia Britannica Inc., 2013, <http://www.britannica.com/EBchecked/topic/228936/genetics> (30 November 2013).

1.3. Robotics

A *robot* is any automatically operated machine that replaces human effort, though it may not resemble human beings in appearance or perform functions in a humanlike manner[5]. By extension, *robotics* is the engineering discipline dealing with the design, construction, and operation of robots. Many aspects of robotics involve artificial intelligence; robots may be equipped with the equivalent of human senses such as vision, touch, and the ability to sense temperature. Some are even capable of simple decision-making, and current robotics research is geared toward devising robots with a degree of self-sufficiency that will permit mobility and decision-making in an unstructured environment[6]. Today's industrial robots generally do not resemble human beings, although many advances are being accomplished toward that direction (recently, the 11th July 2013, the U.S. company *Boston Dynamics* revealed an experimental version of *Atlas*, the «Agile Anthropomorphic Robot»)[7]. A robot in human form is called an android.

Robots may be *manned*, that is to say, transporting or operated by men, or *unmanned*, that is, machines capable to perform their actions without the direct human intervention. Such a distinction is not coincident with the distinction between *autonomous* and *non-autonomous* robots:

a) *autonomous* robots are systems capable of operating (therefore, performing functions, actions and tasks) in the real-world environment without a form of external control for extended periods of time[8];
b) *non-autonomous* robots are machines that cannot autonomously survive or perform useful tasks in the real world for extended periods, except in highly structured, stable and non-disturbed situations[9].

2. The employment of genetics in crime prevention

Genetics may be used in crime prevention basically in two ways:

1. to establish whether a person is *genetically predisposed* to crime or antisocial behaviours (that is, to assess his dangerousness).
2. to collect and *retain DNA samples* of individuals in special databases or banks

[5] Entry «Robot», in *Encyclopædia Britannica. Encyclopædia Britannica Online*, Encyclopædia Britannica Inc., 2013, <http://www.britannica.com/EBchecked/topic/505818/robot> (8 September 2013).
[6] Entry «Robotics», in *Encyclopædia Britannica. Encyclopædia Britannica Online*, Encyclopædia Britannica Inc., 2013, <http://www.britannica.com/EBchecked/topic/1384950/robotics> (8 September 2013).
[7] More info on the Boston Dynamics Website <http://www.bostondynamics.com/robot_Atlas.html> (12 April 2014) and on <http://spectrum.ieee.org/automaton/robotics/humanoids/video-boston-dynamics-atlas-robot-revealed> (12 April 2014).
[8] G.A. Bekey, *Autonomous Robots: From Biological Inspiration to Implementation and Control*, Cambridge (MA), MIT Press, 2005, p. 1.
[9] Id., *ibid.*, p. 2.

in order to compare them with those found on the scenes of crimes, so to detect the authors of crimes.

2.1. Human behavioural genetics and criminal trial (special prevention)

The finding of genetic predisposition to crime is entrusted to the area of human behavioural genetics and it serves purposes of *special prevention*.

Genetic evidence of a predisposition to crime might be used to demonstrate the dangerousness of a person and to determine whether the person should be subjected to particular pre-crime or post-crime measures. Moreover, genetic determination to crime may be considered a ground to *exclude* (or *reduce*) personal criminal responsibility as well as a *mitigating factor*.

A concrete example of the use of genetics to measure individual criminal responsibility is offered by American and Italian case law.

During the last two decades, U.S. courts have been variously considering behavioural genetics evidence in more than eighty criminal cases, starting from the case of Stephen Mobley[10]. The overall impact of such cases and the trends they demonstrate have been thoroughly analysed by Deborah Denno's «longitudinal» studies[11], which conclude that generally U.S. courts «accept behavioral genetics evidence in the majority of cases in which defense attorneys attempt to offer it»[12].

In Italy two particular cases, in which two different courts maintained the defendants' partial mental insanity («*vizio parziale di mente*»)[13] also due to genetic alterations, are worth being mentioned: the decision n. 5 of 18 September 2009 of the Assize Court of Appeal of Trieste[14] and the decision of 25 May 2011 of the judge for the preliminary investigations of Como in the Albertani case[15].

[10] Mobley v. State, 426 S.E.2d 150, 151 (Ga. 1993); Mobley v. State, 455 S.E.2d 61, 65 (Ga. 1995); Turpin v. Mobley, 502 S.E.2d 458, 461 (Ga. 1998).

[11] D. Denno, *Courts' Increasing Consideration of Behavioral Genetics Evidence in Criminal Cases: Results of a Longitudinal Study*, in "Michigan St. L. Rev.", 2011, pp. 967-1047; Id., *Revisiting the Legal Link Between Genetics and Crime*, "Law & Contemp. Probs.", 68, 2006 pp. 209-57; Id., *Behavioral Genetics Evidence in Criminal Cases: 1994-2007*, in N. A. Farahany (ed.), *The Impact of Behavioral Sciences in Criminal Law*, New York, Oxford University Press, 2009, pp. 317-54, 465-98.

[12] D. Denno, *Courts' Increasing Consideration*, cit., p. 1028.

[13] The Italian penal code distinguishes *total* insanity («*vizio totale di mente*») from *partial* insanity (or «semi-infirmity»). The former excludes mental competence (that is the capability of understanding and willing) and, therefore, imputability: the offender will not be punished at all. The latter simply diminishes mental competence and therefore does not exclude imputability, but punishment is mitigated (articles 85, 88 and 89 of the penal code).

[14] Corte d'Assise d'Appello di Trieste, n. 5 of 18 September 2009, in "Riv. pen.", 2010, p. 70 ff., with a comment by A. Forza, *Le neuroscienze entrano nel processo penale*.

[15] G.i.p. Como, 20 September 2011, in "Guida al diritto", 30 agosto 2011, con nota di P. Maciocchi, *Gip di Como: le neuroscienze entrano e vincono in tribunale*. See also F. Casasole, *Neuroscienze, genetica comportamentale e processo penale*, in "Dir. pen. proc.", 2012, p. 110 ff. and M.T. Collica, *Il*

Without repeating here what others have already told (with much more detail), I just want to point out three common features of the decisions of the Courts of both Countries:

1. both American and Italian courts are oriented to admit the use of genetic evidence in criminal trial;
2. so far, both American and Italian courts used it in favour of the defendant, generally considering the genetic predisposition to crime as a mitigating factor[16];
3. so far, both American and Italian courts have considered genetic factors not as isolated criteria to assess the personality of the defendant, but as one of the many variables influencing human behaviour (such as environmental and developmental factors).

So far…

2.2. The collection and retention of DNA materials

The collection and retention of DNA samples and profiles is entrusted to the area of genomics and, other than having investigative purposes, it has also general preventive effects.

The fact that State authorities retain the DNA profile of an individual may deter him from committing any crimes, for fearing that he might be easily individuated as the author of the crime if the DNA traces found on the crime scene should match his stored DNA profile.

An example of such practice is given by the legislation of the United Kingdom, which was the first country to use a DNA dragnet and to develop a national DNA database[17].

Until recently, U.K. law consented the indefinite retention of DNA material from anybody arrested, whether innocent or convicted. The system had a statutory basis in section 64 (1A) of the *Police and Criminal Evidence Act 1984* (PACE) – as amended by the *Criminal Justice and Police Act 2001* (CJPA) and the *Criminal Justice Act 2003* (CJA)[18] – which provides for powers for the taking, retention and use of fingerprints and samples, and the retention and use of DNA profiles. Particularly, according to section 64 of PACE (as amended by CJA), when investigating on a crime, the police

riconoscimento del ruolo delle neuroscienze nel giudizio di imputabilità, in "Dir. pen. contemporaneo", 15 February 2012, in <http://www.penalecontemporaneo.it/materia/1-/62-/-/1264-il_riconoscimento_del_ruolo_delle_neuroscienze_nel_giudizio_di_imputabilit_/> (10 April 2014).

[16] Cf. also D. Denno, *Courts' Increasing Consideration*, cit., p. 1027 ff.

[17] N. Beniquez, *We Have Your DNA, Come Out with Your Hands Up! The Three D's of DNA: A Fourth Amendment Analysis of the Trilemma*, in "T.M. Cooley J. Prac. & Clinical L." 13, 2010-2011, p. 540.

[18] Further amendments were introduced by the Serious Organised Crime and Police Act 2005 and the Counter-Terrorism Act 2008.

may collect and store in the National DNA Database (NDNAD) DNA samples from people arrested for any recordable offence (that is, from mere suspects).

Later, such system expanded under what has been described as regulatory «light touch»: no statutory guidance for decisions about the retention of samples, no readily accessible mechanism whereby individuals can challenge the decision to retain their records (other than judicial review) and no independent oversight by a designated regulatory body[19]. Police ended up with indefinitely retaining the DNA profile obtained from such samples even if the individual was never charged or even if the person was later acquitted of any crime.

UK courts denied that such retention constituted an interference with privacy rights (and especially with the rights set by article 8 of the European Convention of Human Rights). This was clearly stated by the Divisional Court and by the House of Lords in the S. and Marper case[20]. It was the European Court of Justice that affirmed, in the same case, that such a regulations violated the individual right to private life[21].

The European Court found that «the blanket and indiscriminate nature of the powers of retention of the fingerprints, cellular samples and DNA profiles of persons *suspected but not convicted* of offences» (our emphasis), as applied in the S and Marper case, «fails to strike a fair balance between the competing public and private interests» and that the United Kingdom has overstepped any acceptable margin of appreciation in this regard. Accordingly, the Court maintained that the retention at issue constitutes a disproportionate interference with the applicants' right to respect for private life and cannot be regarded as necessary in a democratic society[22].

Following the European Court's decision, the Unite Kingdom enacted the *Protection of Freedoms Act 2012*, in the aim of striking a new balance between protecting the privacy and human rights of the public, and protecting them from crime by keeping the right people on the DNA and fingerprint databases. According to such Act the DNA samples shall be in any case destroyed after six months from being taken. Nevertheless, the DNA profiles obtained from such samples may still be retained according to different regimes. If later the arrested suspect is convicted, his DNA profile can be retained indefinitely (except for minor offences committed by minors). If the arrested suspect is not convicted, his DNA profiles may be retained for up to five years, under particular conditions.

In any case, the Act allows speculative searches of DNA profiles against crimes stored on the databases, to check if they match to any crime on the database. Once a speculative search has been completed, the profile and fingerprints are deleted.

[19] S. Beattie, *S and Marper v UK: privacy, DNA and crime prevention*, in "Eur. Hum. Rights L. Rev.", 2009, pp. 229-230.
[20] *S and Marper* [2002] "EWHC" 478; [2002] "Po. L.R." 273; *S and Marper* [2004] "UKHL" 39; [2004] 1 "W.L.R." 2196.
[21] E.Ct.H.R., *S and Marper v. United Kingdom* (App. Nos 30562/04 & 30566/04), judgment of 4 December 2008.
[22] E.Ct.H.R., *S and Marper v. United Kingdom*, cit., p.125.

3. The employment of robotics in crime prevention

Many countries already use robots for different preventive purposes. Although the employment of robotics in crime prevention is far more variegated than that of genetics, it often passes unnoticed to the eyes of the lawyer, as it is still relegated to the field of mere praxis, lacking specific legal regulations.

3.1. Surveillance

Surveillance is one of the most typical means of crime prevention. It can be used either as a *generic measure*, to watch over the activities of the general population in certain areas, or within the application of *individual measures*, to watch particular dangerous or suspect individuals[23]. Surveillance may be useful either to prevent the *immediate* commission of a crime (allowing an early intervention of police forces, as soon as they perceive through their surveillance ongoing criminal activities) and to serve as a general deterrent for the *remote* commission of a crime (knowing that some areas are under surveillance, people avoid to perpetrate any offence fearing they would be discovered).

Robot machines allow for several kinds of surveillance and in the most disparate conditions, such as *air surveillance*, *ground surveillance*, *climbing surveillance*.

As for *air surveillance*, for instance, Noel Sharkey of the University of Sheffield reported that the police in Liverpool and Glasgow acquired German made hicam microdrones for surveillance operations and that the Staffordshire police deployed one at the 2007 V music festival[24]. Another example of flying robot suitable for air surveillance is the *DelFly* dragonfly-shaped flying surveillance drone developed by the Delf University of Technology, Netherlands[25].

As for *ground surveillance*, a most significant example is given by small robots, generally equipped with cameras, sensors and alarms, used to patrol the grounds in

[23] On the distinction between generic and individual preventive measures see L. Pasculli, *Dangerous Prevention*, forthcoming. See also G. Canepa, *Aspetti criminologici delle misure di prevenzione con particolare riguardo alla legge 27 dicembre 1956, n. 1423*, in *Le misure di prevenzione*, Atti del Convegno «Enrico De Nicola» (Alghero, 26-28 aprile 1974), Milano, Giuffrè, 1975, p. 109 ff.

[24] N. Sharkey, *2084: Big Robot is watching you. Report on the future of robots for policing, surveillance and security*, 2008, in <http://staffwww.dcs.shef.ac.uk/people/N.Sharkey/> (9 September 2013).

[25] J.V. Caetano, J. Verboom, C.C. de Visser, G.C.H.E. de Croon, B.D.W. Remes, C. de Wagter, M. Mulder, *Near-Hover Flapping Wing MAV Aerodynamic Modelling - a linear model approach*, in "Int'l J. Micro Air Vehicles", 5, 4, 2013; G.C.H.E., de Croon, M.A. Groen, C. De Wagter, B.D.W. Remes, R. Ruijsink, B.W. van Oudheusden, *Design, Aerodynamics, and Autonomy of the DelFly*, in "Bioinspiration and Biomimetics", 7 (2), 2012; G.C.H.E., de Croon, K.M.E. de Clerq, R. Ruijsink, B. Remes, C. de Wagter, *Design, aerodynamics, and vision-based control of the DelFly*, in "Int. J. Micro Air Vehicles", 1(2), 2009, p. 71 ff.; K.M.E. de Clerq, R. de Kat, B. Remes, B.W. van Oudheusden, H. Bijl, *Aerodynamic Experiments on DelFly II: Unsteady Lift Enhancement*, in "Int. J. Micro Air Vehicles", 1(4), 2009, p. 255 ff. For more info and references see <http://www.delfly.nl> (11 April 2014).

various situations. Two robots of this kind are OFRO, meant for outdoor surveillance, and MOSRO, meant for indoor surveillance, both produced by *Mega Italia S.p.a.*[26]. OFRO was employed by the Seoul authorities to watch out for potential paedophiles in school playgrounds and to provide surveillance at the Seoul World Cup in 2006 (China used two analogous robots, the *Dragon Guard X3* portable robot developed by Shanghai's *Grandar Robotics* and the *RAPTOR* made by *Beijing Universal Pioneering Technology Co., Ltd.*, for surveillance purposes at the Beijing Olympics in 2008)[27]. MOSRO is aimed at offering continuous surveillance in interior environments, such as private houses, banks, offices and so on.

The recent developments in robotics also brought to the creation of climbing robots that could be employed for the most disparate military or police operations. One example is the *RiSE* robot developed by Boston Dynamics in conjunction with researchers at University of Pennsylvania, Carnegie Mellon, UC Berkeley, Stanford, and Lewis and Clark University and funded by DARPA[28].

Curiously enough, the absence of regulations concerning the use of robotics for surveillance purposes led to cases of prevention of police abuses by private citizens. During the *Occupy Wall Street* manifestation in New York one of the protesters, Tim Pool, purchased and used a *Parrot AR* drone (called «occucopter») to watch over possible police abuses[29].

3.2. Formation, education and information

Some of the most important (positive) measures of prevention are those aimed at fostering the spontaneous adhesion of the general public and of possible offenders to the values of society, as well as those aimed at developing an adequate awareness of the risks of crime and the preventive remedies amongst possible victims (so-called *prevention of victimisation*, also fostered by supranational and international law)[30]. Robots may be well employed to such purposes.

Several Police Departments in the United States of America, such as, for instance, the Crime Prevention Officers of the Gainesville Police Department (Florida)[31],

[26] F. Tarissi, *Ecco i robots vigilantes*, in "La Repubblica", 12 March 2007, <http://ricerca.repubblica.it/repubblica/archivio/repubblica/2007/03/12/ecco-robot-vigilantes.html> (11 April 2014).

[27] N. Sharkey, *2084: Big Robot is watching you*, cit.

[28] A. Asbeck, S. Kim, M.R. Cutkosky, W.R. Provancher, M. Lanzetta, *Scaling Hard Vertical Surfaces with Compliant Microspine Arrays*, in "Int. J. Robotics Research", 25 (12), 2006, pp. 1165 ff.; K. Autumn, A. Dittmore, D. Santos, M. Spenko, M. Cutkosky, *Frictional adhesion: a new angle on gecko attachment*, in "J. Exp. Biol.", 209, 2006, p. 3569 ff.

[29] Cf. N. Sharkey, S. Knuckey, *Occupy Wall Street's «occucopter» – who's watching whom?*, in "The Guardian", 21 December 2011, in <http://www.theguardian.com/commentisfree/cifamerica/2011/dec/21/occupy-wall-street-occucopter-tim-pool> (9 September 2013).

[30] Cf. L. Pasculli, *Le misure di prevenzione del terrorismo e dei traffici criminosi internazionali*, cit., pp. 110-119 and 190.

[31] See the official Website of the Gainesville Police Department <https://www.gainesvillepd.org/index.

incorporate the use of robots to divulgate among young students crime prevention information in schools, in order to help make crime prevention more memorable.

Another example of robot use for educational and informational purposes is the *R Bot 001*, a police robot developed by Moscow State Technical University and factually experimented in the Russian city of Perm. *R Bot 001* can record offences against the law using its five cameras, and also urge citizens to legality, for instance by reciting local statutes or by inviting drinkers to take their alcohol indoors. Moreover the robot has a panic button for passersby to call the police[32].

3.3. Police guarding and patrolling

Of course, the possibility of combining surveillance skills with information skills suggested the creation of more complex robots capable of providing certain services typical of policemen on patrol.

Other than the Russian *R Bot 001*, an example of robot «policemen» is the robot experimented in China by the Changping District of Beijing police, meant to be used where cameras cannot be installed and where incidents happen frequently. It is a humanoid robot equipped with four video cameras: three in the head and a pinhole camera in its chest. By pressing a red button on the robot's stomach citizens will be automatically connected with police headquarters and speak directly to an officer using a microphone installed on the robot's chest[33].

Robots made their way also as prisons guards. A prison in Pohang, South Korea, is running a field trial of roving and autonomous robotic prison guards (called «Robo-Guards») developed by the Asian Forum for Corrections in concert with the Electronics and Telecommunications Research Institute and manufacturer SMEC[34]. Such robot guards are equipped with 3D depth cameras, a two-way wireless communication system, and software programmed to recognize certain human behaviours and a cycloptic eye aimed at identifying troubles while patrolling the corridors of the prison block. The robot is designed to conduct self-directed patrols,

php?option=com_content&view=article&id=47:crime-prevention&catid=40:information&Itemid=58> (11 April 2014).

[32] A.F.P., *Un robot policier en patrouille dans les rues de Perm en Russie*, in "Libération", 30 June 2007, in <http://www.liberation.fr/monde/2007/06/30/-_97358> (9 September 2013); see also N. Sharkey, *2084: Big Robot is watching you*, cit.

[33] N. Sharkey, *2084: Big Robot is watching you*, cit.

[34] See A. Knapp, *South Korean Prison To Feature Robot Guards*, in "Forbes", 27 November 2011, <http://www.forbes.com/sites/alexknapp/2011/11/27/south-korean-prison-to-feature-robot-guards/> (12 April 2014); C. Palis, *Robo-Guard: Robot Prison Guard Is The First Of Its Kind*, in "Huffington Post", 16 April 2012, <http://www.huffingtonpost.com/2012/04/16/robo-guard-prison-south-korea_n_1428736.html> (12 April 2014); L. Kim, *Meet South Korea's New Robotic Prison Guards*, in "www.digitaltrends.com", 21 April 2012, <http://www.digitaltrends.com/international/meet-south-koreas-new-robotic-prison-guards/> (12 April 2014); BBC News – Technology, 25 November 2011, in <http://www.bbc.co.uk/news/technology-15893772> (8 September 2013).

guided by navigation tags located along corridor ceilings, but is supervised by a human guard and can be controlled via iPad. The pattern recognition algorithms focus on «risky behaviour»[35] that signals trouble and can alert controllers, so that in case of emergency (e.g., suicide attempt, assault, arson…) correctional officers may respond. In less serious situations, two-way cameras and microphones allow the human guards at the control centre to communicate directly with restive prisoners, so to prevent any disorder. At the moment, this «Robo-guard» does not incorporate any features that would involve physical interaction with prisoners (alleviating the reservations of inmates, apparently concerned with the possibility of being roughly handled by the machines). Nevertheless, according to the press, although still unrealised, the idea of incorporating a functionality capable of conducting body searches is already in the mind of the robot's designers[36].

Patrolling robots are also used in Nevada, where the U.S. National Nuclear Security Administration employed a robot machine called MDARS («Mobile Detection Assessment Response System») to patrol its radioactive waste facility[37].

3.4. Use of force

Robots are also employed in crime prevention activities to exercise physical force against things or against persons (*coercion*), so to prevent harm and injuries to human agents (generally policemen or soldiers, but also citizens and possible crime victims).

An example of robots using force against things in police operations are the robots employed by police and SWAT (Special Weapons And Tactics) teams for the most disparate dangerous tasks such as breaking down doors, approaching hostage takers, searching buildings, smashing windows and taking mobile phones to barricaded suspects[38]. Amongst such robots there are, for instance, the *ANDROS Remotec*, a machine originally intended for bomb disposal, used by police and military forces all over the world, and the *Dragon Runner*, a lightweight, back-packable, multi-terrain robot capable of detecting a variety of devices without putting the operator in harm's way, which helps bomb disposal experts find and deactivate improvised explosive devices. *Dragon Runner* also has the ability to dig around suspicious objects with a manipulator arm, pick them up and move them, place small charges to disrupt suspect devices, send video footage back to the operator at a safe distance thereby enabling troops to assess a situation prior to moving forward or entering a structure, potentially safeguarding lives. Further enhancements, including the incorporation of

[35] A. Knapp, *South Korean Prison To Feature Robot Guards*, cit.
[36] L. Kim, *Meet South Korea's New Robotic Prison Guards*, cit.
[37] L. Benedictus, *Robot soldiers patrol America's radioactive waste dump*, in "The Guardian", 24 October 2010, in <http://www.theguardian.com/science/2010/oct/24/nasa-robots-on-patrol> (8 September 2013).
[38] N. Sharkey, *2084: Big Robot is watching you*, cit.

wire-cutters, have been implemented. *Dragon Runner* was used by British troops in Afghanistan[39].

The mechanical force of robots may be also employed against human persons. In 2007 the American *iRobot* corporation teamed up with *Taser Inc.*, a stun-gun manufacturer, to arm track-wheeled robots for the police and the Pentagon. Such robots (called *PackBot*) incorporate *Taser* X26 guns, non-lethal electroshock weapons using electrical current to disrupt voluntary control of muscles causing neuromuscular incapacitation. South Korea uses armed sentry robots to protect its borders[40]: SGR-A1, a gun-toting sentry robot, developed five years ago by *Samsung Techwin Co.* for the South Korean government is a fixed robot using pattern recognition software to spot humans and a machine gun if needed. The South Korean defence company *DoDAAM* is developing robotic gun turrets for export which can be programmed to open fire automatically[41]. Similar robots are also used in Israel, where *G-NIUS Unmanned Ground Systems (UGS) Ltd.*, an equally shared company of *Israel Aerospace Industries (IAI)* and *Elbit Systems Ltd.*, developed *Guardium*, an unmanned security vehicle capable remotely controlled by a command centre, equipped with cameras, night-vision, sensors and suitable to be armed with machine-guns or less-lethal weaponry[42].

Conclusively, robots may be used as means of both *positive* and *negative* prevention. Of course, it is the latter that gives rise to most problems, especially with regard to the possible compressions or intrusions on fundamental human rights by robot devices. At the present moment, the most worrisome developments in the employment of robotics for negative prevention are represented by the use of drones as weapons or robot soldiers in war.

One might be tempted to consider such developments useful and legitimate, as they might save human lives by replacing human soldiers with robots in the most critical missions, but the issues at stake are many and disquieting. First of all, robots, like humans (and inasmuch as programmed or controlled by humans), are fallible, so they can commit mistakes (e.g. killing a civilian or a friend target, instead of an enemy) and when such mistakes involve the use of lethal weapons they cannot be considered light-heartedly. Secondly, the employment of robots may entail the increase of violence in war, as robots have not the human feelings of prudence, compassion, justice and common sense that can spare many lives and, generally, bring some humanity in theatres of war. Finally, it is well known that a recent trend

[39] More information can be found on the British Army's official Internet website <https://www.army.mod.uk/equipment/23256.aspx> (8 September 2013).
[40] L. Kim, *Meet South Korea's New Robotic Prison Guards*, cit.
[41] BBC News – Technology, 25 November 2011, cit.
[42] Cf. N. Sharkey, *2084: Big Robot is watching you*, cit.; A. Krishnan, *Killer Robots: Legality and Ethicality of Autonomous Weapons*, Ashgate, Farnham 2009, p. 72; L. Benedictus, *Robot soldiers patrol*, cit.

in crime prevention is resorting to emergency or war measures to prevent («fight») exceptional forms of criminality, often very close to acts of war (such as terrorism). It cannot be excluded that such trend might expand as to include the employment of military armed robots to preventatively protect society from «extraordinary» criminal aggressions also in normal (non-emergency) times. We also know that the use of emergency measures for normal situations carries the risk of the *normalisation* of such measures, that is, the definitive settlement in the legal order of exceptional measures (as such, derogating the principles and safeguards normally protecting human rights) as ordinary means to prevent crime[43]. Thus, balances of interests stroke for the peculiar context and reasons of war end up with being unreasonably (and unjustifiably) applied also in perfectly normal circumstances, which call for totally different tradeoffs. If this is the trend, then I would not be surprised if some day soon someone suggested the use of military drones or deadly armed robots in ordinary police activities.

Moreover, some recent developments in robotics make it possible to predict that robots could be used, possibly together with genetic techniques, to assess individual dangerousness. There exist already robots that are capable to recognize behavioural patterns, such as the Pohang «Robo-Guards» or the South Korean SGR-A1 sentry robot, and also voice tone and facial expression, such as the so called «conversational robots» like *Robita* and, especially, *Robisuke* and its less publicised evolution *Schema*, all developed by Waseda University's Kobayashi Lab of Perceptual Computing in Japan, respectively in 1999, 2003 and 2009. *Robisuke*, in particular, has gaze direction recognition, head gesture recognition, and facial expression recognition[44]. Now, it is

[43] On the so-called normalization of emergency see, amongst others, O. Gross, F. Ní Aoláin, *Law in Times of Crisis. Emergency Powers in Theory and Practice*, Cambridge University Press, Cambridge (MA) 2006; O. Gross, *Chaos and Rules: Should Responses to Violent Crises Always Be Constitutional?*, in "Yale L.J.", 112, 2003, p. 1011 ff.; K.L. Scheppele, *North American emergencies: The use of emergency powers in Canada and the United States*, in "Int'l J. Const. L.", 4, 2006, p. 213 ss. With specific regard to criminal law, see M. Pelissero, *Il diritto penale politico tra esigenze di normalizzazione ed istanze deflattive. Il contributo di Mario Romano alla riforma*, in M. Bertolino, L. Eusebi, G. Forti, (a cura di), *Studi on. Mario Romano*, I, Napoli, Jovene, 2011, p. 453 ff.; S. Moccia, *La perenne emergenza, Edizioni Scientifiche Italiane*, Napoli 1997; A. Bernardi, *Ombre e luci della politica criminale italiana nell'era delle perenne emergenza*, in "Annali dell'Università di Ferrara – Scienze Giuridiche", XVII, 2003, p. 17 ff. On the normalization of emergency in (negative) crime prevention (and also for further references) see L. Pasculli, *Le misure di prevenzione*, cit., pp. 96, 124 ff., 200-201, 260-261.

[44] For some of the developments of the research staff at the Kobayashi Laboratory on such robot features see S. Fujie, Y. Matsuyama, H. Taniyama, T. Kobayashi, *Conversation robot participating in and activating a group communication*, in *Interspeech 2009*, proceedings of the 10th Annual Conference of the International Speech Communication Association (Brighton, U.K., 6-10 September, 2009), 2009, p. 264 ff.; K. Hoshiai, S. Fujie, T. Kobayashi, *Upper-body Contour Extraction Using Face and Body Shape Variance Information*, in proceedings of *The 3rd Pacific-Rim Symposium on Image and Video Technology* (PSIVT2009, Tokyo, 13-16 January 2009), 2009, p. 862 ff.; S. Fujie, Y. Ejiri, Y. Matsusaka, H. Kikuchi, T. Kobayashi, *Recognition of para-linguistic information and its application to spoken dialogue system*, in proceedings of *IEEE ASRU 2003* (Automatic Speech Recognition and

not difficult to imagine that the further evolution of such robots could be their employment to infer personal dangerousness from human attitudes or expressions, perhaps based on catalogues of expressions such as those elaborated by Paul Ekman[45].

There is no need to say that if someday such abilities will be combined in the same robot with the ability to autonomously use deadly weapons against those that the AI algorithms of the robot recognise as suspect or dangerous, the result will be most disturbing, especially considered the above mentioned lack of any human feeling in robots. In any case, as the employment of robots increases, soon some solid regulation will be needed.

4. Genetics, robotics, crime prevention and human rights

Crime prevention is but a means of protection against the most harmful aggression to the most significant interests and goods of the human person, both as an individual and as a member of a social formation. If crime prevention aims at protecting the human person, then the condition for its legitimacy is that crime prevention itself does not turn into an arbitrary violation of the human person. Any preventive measure entailing *irrational* (inasmuch as determined by fear or by the sense of insecurity rather then by rational assessments or because of their indemonstrable effectiveness) or *unreasonable* (inasmuch as based on unacceptable balances of interests) sacrifices of rights and liberties of the human person would be *unjust*[46] and, therefore, illegitimate.

Understanding Workshop, St. Thomas, U.S., 30 November-3 December 2003), 2003, p. 231 ff.; Y. Matsusaka, T. Tojo, T. Kobayashi, *Conversation Robot Participating in Group Conversation*, in "IEICE Trans. on Information and Systems", vol. E86-D, n.1, 2003, p. 26 ff. Other references in the official Internet Website of the Kobayashi Laboratory of Waseda University: <http://www.pcl.cs.waseda.ac.jp/> (8 September 2013).

[45] P. Ekman, *Emotions Revealed. Recognizing Faces and Feelings to Improve Communication and Emotional Life*, Holt, New York, 2007[2]; P. Ekman, W.V. Friesen, *Unmasking the Face: A Guide to Recognizing Emotions from Facial Clues* (1975), Cambridge (MA), Malor Books, 2003; P. Ekman, *Darwin and Facial Expression: A Century of Research in Review*, New York, Academic Press, 1973, drawing on C. Darwin, *The Expression of the Emotions in Man and Animals* (1872), anniversary ed., with an introduction, afterword and commentaries by Paul Ekman and an essay on the history of the illustrations by Phillip Prodger, London, Harper, 2009.

[46] For a conception of man as a reasonable and rational animal see G. Bettiol, *Sistema e valori nel diritto penale*, in "Jus", 1940, now in Id., *Scritti giuridici*, I, Padova, CEDAM, 1966, p. 498 (for further notes and references: S. Riondato, *Un diritto penale detto «ragionevole». Raccontando Giuseppe Bettiol*, Padova, CEDAM, 2005, pp. 1 ff.). Cf. also J. Rawls, *Political Liberalism*, New York, Columbia University Press, 1993, p. 50 ff.; Id., *A Theory of Justice* (1971), rev. ed., Cambridge (MA), Belknap Press of Harvard University Press, 1999, *passim*; Id., *Lectures on the History of Political Philosophy*, Cambridge (MA), Harvard University Press, 2007, p. 54 ff. (also referring to T. Hobbes, *Leviathan*, London, Andrew Crooke, 1651).

The minimum threshold of legitimacy of any genetic and robotic measure of crime prevention shall be its compliance with the safeguard of fundamental individual rights and liberties typical the rule of law and protected by international human rights law. Many rights and principles are at stake, such as the right to liberty and security, the right to respect for private and family life, right to health and the prohibition of any discrimination.

4.1. Genetics, robotics and individual dangerousness

In this regard, one of the most interesting problems is the trust that some might place on the capacity of genetics and robotics to detect *individual dangerousness*, which in many jurisdictions is the ground for the application of the most disparate – also restrictive and incapacitating – preventive measures.

Human behaviour is a complex phenomenon. Genetics may have a role in influencing human behaviour, but many scholars recognize that:

1. other variables, such as environmental factors, seem to have even a more significant effect on human behaviour than genes;
2. being genetically predisposed to crime does not necessarily mean to be determined to crime[47]. Predisposition could at the best individuate the mere *possibility* that an individual engages in criminal activities (that is a generic risk of crime) rather than the *probability* of which individual dangerousness consists.

This conclusion seems to be well known to Italian and American courts, which consider genetic information together with many other factors to assess individual responsibility and dangerousness. Given the difficulty determining the weight of each of these factors, the self-constraint of Italian and American courts in limiting the use of genetics only when favourable to the defendant is worth appreciation. Nevertheless, the absence of a specific legal regulation of these issues cannot prevent that the courts start using genetics also to prove criminal responsibility and individual dangerousness.

The introduction of some legal constraint is, therefore, needed. Law should intervene to set the limits of the possible use of genetics for penal and crime preventive purposes, according to the *in dubio pro reo* principle. Such limits shall be individuated in the margins of uncertainty of genetics: where the results of genetic analysis cannot lead to certain conclusions they should not be used against a defendant (whereas, on the contrary, they could be well use in favour of a defendant even if they are uncertain). More generally, the proved impact of genetic factors on the causation of criminal behaviours shall be considered as a key feature of a system

[47] On these two propositions cf. the «points of (near) consensus» listed by O.D. Jones, *Behavioral Genetics and Crime, in Context*, in "Law & Contemp. Probs.", 68, 2006, pp. 86-88.

of *positive measures* aimed at improving the whole life conditions of an individual so to attract him to legality, while subtracting him from crime.

As for robotics, one of the most worrisome scenario is the development of robots capable to perform *autonomous* actions (which may also be harmful for human beings), *autonomous* evaluations and to take *autonomous* decisions, that is, to think and act against man without the control of man. Being the human person the very foundation of crime prevention, it would not be admissible that a robot device could assess individual dangerousness and decide whether and in what measure to restrict human liberty or to harm or incapacitate a human being for preventive purposes. As a *reasonable and rational animal*, man (even the most dangerous man) deserves to be dealt with only by other reasonable and rational animals, according to the principles of rationality and reasonableness and to that sense of justice typical of humanity[48]. Besides, that is why criminal law jurisprudence has been moving so many steps towards humanisation in the last centuries[49]. Entrusting robots with the administration of preventive functions and measures that, like punishment, entail the compression of fundamental right would represent a serious regression: a de-humanisation of criminal law and crime prevention.

In particular, the robot assessment of individual dangerousness would necessarily imply the codification of a sort of catalogue of indicators of dangerousness, which the machine should be programmed to detect and to react to. Such a codification would be unavoidably based on statistics and therefore would not be able to ensure that degree of certainty that is necessary to lawfully compress individual liberty or physical integrity. Without the control of the man there could always be the case of false positives. For instance, how could a robot policeman programmed to detect and react to facial expressions understand if the aggressive expression on the face of a suspect is real or fake or playful? How can a robot soldier programmed to kill soldiers wearing enemy uniforms distinguish real enemies from infiltrated friendly soldiers in disguise? How can a sentinel robot programmed to shoot at those who trespass the boundaries of a country recognise and spare a children who is just chasing his balloon in the foreign territory?

Given such risks, robots shall never be employed to autonomously determine any harm or restriction to the individual legal sphere, without proper human control.

On the contrary, a healthy and interesting development of robotics shall consist in their use for *positive* measures, to perform tasks that the human being could never

[48] On the conception of man as a reasonable and rational animal see G. Bettiol, *Sistema e valori nel diritto penale*, cit.

[49] G. Bettiol, *Sull'umanizzazione del diritto penale*, in "Riv. it. dir. pen.", 1949, p. 1 ff., now in Id., *Scritti giuridici*, II, cit., p. 746 ff. (on Bettiol's opinions see G. Marinucci, *Giuseppe Bettiol e la crisi del diritto penale negli anni Trenta*, in "Riv. it. dir. proc. pen.", 2008, p. 929 ff.). Cf. also G. Delitala, *Il rispetto della persona umana nell'esecuzione della pena*, in "Iustitia", 1956, p. 316 ff. and M.A. Cattaneo, *Pena, diritto e dignità umana*, Torino, Giappichelli, 1990.

perform (e.g. aerial surveillance), to prevent harm to police forces, to criminals and to victims (e.g. bomb disposal robots), to carry materials too heavy for men (e.g. *Big Dog* and *LS3* robots, developed by the U.S. *Defense Advanced Research Projects Agency* - DARPA – and *Boston Dynamics*) [50] and also for informative, educational, therapeutic purposes.

Thus, genetics and robotics reflect once again the old question of the *means* of crime prevention. Against the insistent (almost obsessive) suggestions that the only way to «fight» a criminality that (especially in our global era) is getting more and more «exceptional» are *negative measures*, I insist in suggesting that *positive measures* are still the most efficient and legitimate way to prevent crime[51]. The resources, technologies and products of globalisation – amongst which robotics and genetics – would be better invested in the development of instruments to support and enhance the personality of the human being, rather than in the multiplication of weapons and measures that compress, incapacitate, neutralise, eliminate this personality in an escalation of violence and (preventive) repression[52] which ultimately is more criminogenic than preventive – especially on the global scale and over the long term[53].

5. Conclusive remarks

I conclude with two propositions.

First, if crime prevention is the protection of the human being, then the human being shall be, therefore, the only and ultimate paradigm around which any robot or genetic measure shall be construed. The human person shall remain the value to protect, while genetics and robotics are *mere instruments* of protection. This also means that genetics should not pretend to alter human nature, as robotics should not pretend to replace it.

[50] For more information on *BigDog* see the official *Boston Dynamics* Internet Website <http://www.bostondynamics.com/robot_bigdog.html> (8 September 2013). For details on the locomotion system of such robots see D.E. Koditschek, R.J. Full, M. Buehler, *A Principled Approach to the Bio-inspired Design of Legged Locomotion Systems*, in proceedings of the SPIE (Defense and Security Symposium), 5422, *Unmanned Ground Vehicle Technology VI*, 2004, p. 86 ff.; D.E. Koditschek, R.J. Full, M. Buehler, *Mechanical Aspects of Legged Locomotion Control*, in "Arthropod Struct. Dev.", 33, 2004, p. 251 ff.

[51] Cf., for instance, F. Bricola, *Forme di tutela* «ante-delictum» *e profili costituzionali della prevenzione*, in *Le misure di prevenzione*, Proceedings of the «Enrico De Nicola» Conference (Alghero, 26-28 April 1974), Milano, Giuffrè, 1975, p. 37 ff. (especially p. 74) and G. Canepa, *Aspetti criminologici delle misure di prevenzione con particolare riguardo alla legge 27 dicembre 1956, n. 1423*, *ibid.*, p. 109 ff. (especially p. 118).

[52] On the concept of «preventive repression» («*repressione preventiva*») see L. Pasculli, *Le misure di prevenzione*, cit., pp. 42-43.

[53] Cf. Z. Bauman, *Liquid Fear*, Cambridge, Polity Press, 2006, p. 96; Id., Modus vivendi. *Inferno e utopia del mondo liquido*, transl. by S. D'Amico, Roma-Bari, Laterza, 2008, pp. 1-7.

Secondly, crime prevention should go beyond mere *protection* of the human personality (negative measures), as it should consist, more profitably, in the *promotion* of such personality (positive measures). The introduction and development of positive measures is, therefore, to be encouraged, especially in view of the rapid evolutions of genetics and robotics, so to *prevent* any possible securitarian misuse or abuse of the future developments of robot and genetic research and technologies. This is also a very good way to start improving our law in view of acknowledging not only its function of mere protection, but also (and especially) a more positive *promotional function* (as Norberto Bobbio would define it)[54] for the human person.

[54] N. Bobbio, *Sulla funzione promozionale del diritto*, in "Riv. trim. dir. proc. civ.", 23, 1969, p. 1312, now as Id., *La funzione promozionale del diritto*, in Id., *Dalla struttura alla funzione. Nuovi studi di teoria del diritto*, Milano, Edizioni di Comunità, 1977, p. 13. N. Bobbio, *The Promotion of Action in the Modern State*, in G. Hughes (ed.), *Law, Reason and Justice. Essays in Legal Philosophy*, New York, New York University Press, 1969, p. 189.