



Convention on Certain Conventional Weapons (CCW)

Meeting of Experts on Lethal Autonomous Weapons Systems (LAWS)

(Geneva, 11-15 April 2016)

NON PAPER

MAPPING OF TECHNOLOGICAL DEVELOPMENTS

Research into artificial intelligence (AI) was initiated in the 1950s, and has made considerable progress recently. The possibility of the first operational versions of autonomous transport vehicles (ONERA project for a pilotless aircraft, Google Car, etc.) now appears feasible within 15 or 20 years, so long as answers are found to the concerns regarding safety and the dilution of responsibilities in these new means of transport. The recent Google Car accident and the round lost by AlphaGo against Go champion Lee Sedol do, however, show that the employment of **artificial intelligence seeking to provide solutions to accomplish tasks that appear “simple” in supposedly “finite” environments** (movement of a vehicle from a point A to a point B using a known road network, or a strategy game on a grid of 19 lines by 19 lines) **cannot resolve all situations encountered in the real world.**

Lethal autonomous weapons systems (LAWS) do not exist. The possibility of their existence – in the form currently imagined in books and films (Terminator, etc.) or in any other form – remains an open question, given the current state of scientific progress in the fields of artificial intelligence and machine learning.

A lethal autonomous weapons system would be characterized by an ability to move freely, to adapt to its environment, and to carry out targeting and launch of a lethal effector (bullet, missile, bomb, etc.). It would operate in complete functional autonomy.

This characterization excludes current automated weapons systems, which do not have autonomous ability to move or adapt to their environment, or whose targeting and launch of effectors continue to be carried out by human operators.

The growing automation of certain operational functions is a response to the increasing complexity of weapons systems. This complexity results from progress in technologies and means of communication, as well as the networking of all weapons systems for network-centric warfare.

For the command and control (C2) of these complex systems, which require human resources and a timescale compatible with operational realities on the ground, humans need an overall view of the situation and help with decision-making.

In this context, the goal of automation is to provide a decision aid for the human operator, to allow them to control the system in an operational situation. **Progress in the area of data acquisition and processing does not allow, however, so far to consider a shift from automated decision aid (“human-in-the-loop”) to autonomous decision-making (“human-off-the-loop”) for targeting and firing.**

An autonomous weapons system would have to function under the total authority of the machine's artificial intelligence, yet any system, even one based on "powerful" AI, runs (adapts and optimizes its behaviour) in a universe modelled by its designer/programmer. In no case does the system itself conceive the expansion of its own universe.

The system's behaviour thus becomes unpredictable when faced with an unmodelled element. **Yet predictability is the very basis for the usefulness and effectiveness of a machine**, especially a weapons system whose effects are destructive or even lethal (regardless of the particular legal and ethical issues of a lethal system used in the context of an armed conflict). Moreover, **the complexity of the battlefield excludes the possibility of modelling it perfectly (environment or behaviour of the various players)**. The recent accident of the Google Car, travelling even more slowly than a pedestrian, demonstrates these difficulties of modelling.

As such, the use of a totally autonomous weapons system, even if one were to exist one day, remains inconceivable with today's technology in real military commitment conditions, as **it would assuredly become unpredictable as soon as the first unmodelled element were encountered**. Such a weapons system would be militarily useless.

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The aim of battlefield robotization is not to replace human personnel, but rather to increase their capabilities and enable to free them from carrying out repetitive, tedious tasks.

The automation of certain functions of weapons systems seeks to address a need to refocus the decision-making process on human operators in a context of these system becoming increasingly complex. It provides a decision aid for commanders, within the human and time constraints of a complex operational situation.

The essential need of the armed forces is to control the effect of the weapons they employ, and to maintain the **fundamental concept of necessarily human responsibility** in the fulfilment of a mission, for operational, legal and moral reasons.