ORIGINAL RESEARCH

Public perceptions of autonomous lethal weapons systems

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Abstract

This study attempts to bridge the gap in empirical and philosophical research on lethal autonomous weapons systems (LAWS), through a survey of attitudes using experimental methods. "LAWS" refer to "fully autonomous weapons" that can set attack targets without human involvement and are lethal. Based on previous research, we conducted a randomized controlled experiment to create, present, and collect responses to scenarios describing military operations and outcomes that are likely to express awareness of the ethical issues raised by LAWS. First, our hypothesis that LAWS are less likely to be used was rejected, and the opposite trend was observed. Second, the hypothesis that civilian casualties rather than combatant casualties would influence LAWS use was strongly and significantly confirmed. Third, the hypothesis that remote weapons are more likely to be used than LAWS was rejected. Fourth, there was some support for the hypothesis that LAWS are more likely to be used in homeland defense. Fifth, the hypothesis that male and younger individuals are more willing to use LAWS was strongly and significantly confirmed for male, but not on the basis of age. This study highlights the need for further discussion based on these findings.

Keywords A randomized controlled experiment · Lethal autonomous weapons systems · Public attitudes · Scenario

1 Introduction

This study attempts to fill the gap in ethical research on lethal autonomous weapons systems (LAWS), to examine citizens' perceptions of LAWS, and to analyze gaps in this debate. LAWS is said to refer to "fully autonomous weapons" that can set attack targets without human involvement and have lethal capabilities. How to define this concept remains tentative and widely debated [33]; since our main research focus is not on the legal or technical dimensions of the use of LAWS, but on the public perceptions of the relatively new military technology, it suffices here to take its simple and literal meaning.

Opposition to the development and use of LAWS has been growing at the citizen level and in intergovernmental consultations since the 2010s. Discussions on LAWS began in 2013, when an international NGO launched the "Campaign to Stop Killer Robots," which led to discussions in international organizations. The need for the international community to address "autonomous lethal robots" was also pointed out in the UN Human Rights Council's Special Report on Haynes. Subsequently, informal meetings on LAWS were held in the framework of the Convention on the Prohibition and Restriction of the Use of Certain Conventional Weapons (CCW) from 2014 to 2016, followed by the Governmental Experts Group (GGE) on LAWS in the framework of CCW from 2017. In November 2019, the GGE agreed on some guidelines for LAWS consisting of 11 items after rounds of discussions, which will be used as a basis for recommendations on the clarification, consideration, and development of the normative and operational framework, with another meeting of the GGE to be held in Geneva in August 2021.

However, the issue is more complicated. The use of LAWS has clear military advantages in reducing the casualties of one's own forces in armed conflict, and it also has technological advantages in terms of information gathering, detection, and decision-making capabilities. The development and use of LAWS in the military domain cannot be neatly separated from the development and use of AI for civilian purposes, and simply advocating a ban on LAWS may impede technological development. Even if people have

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certain concerns about LAWS, the reasons and background need to be carefully articulated.

The main issues in the discussion so far are as follows:

The nature of human involvement (It is internationally recognized that the use of LAWS requires a certain level of human involvement, but what should this involvement be, and in what ways?)

Relationship with international humanitarian law (It is internationally recognized that international humanitarian law must be observed in the use of LAWS. There must be prohibition of unnecessary suffering, and a limitation to combatants and military targets (distinction principle) as well as due weighing of potential damage against military benefits (proportionality principle). How do we ensure compliance with international humanitarian law?)

Relationship with existing weapons (Is it appropriate to regulate all existing weapon systems equipped with autonomous technology such as artificial intelligence? Moreover, how do we delineate the boundary between civilian and weapons-use technologies?)

Regulatory frameworks (What is an appropriate framework for regulating LAWS? Is it legally binding documents, political documents, codes of conduct, or outcome documents pending continuing discussions?)

Considering the current state of affairs, the purpose of this study is to identify public awareness as a source of ethical research and real-world discussion, and to contribute to future rule-making process. To do so, we attempt to verify the following hypotheses by means of a randomized controlled experiment. A randomized controlled experiment is a scientific method that reveals causal relationships by randomly giving different treatments to two or more groups and comparing their effects [13, 3]; in this study, the choices appear randomly for the respondents: (i) LAWS are unlikely to be used. (ii) The number of civilian casualties has a greater influence on the decision to use LAWS than combatant casualties. (iii) Remote weapons are more likely to be used than LAWS. (iv) LAWS are more likely to be used in homeland defense. (v) Males and younger respondents are more willing to use LAWS.

A discussion is needed on how citizens' awareness is positioned in relation to the issues of ethics and political philosophy, and whether it can only be enlightened or whether it can influence the discussion in these fields. It should be reflected through political and social conditions, but it should also be heavily influenced by technological developments. However, in this study, we do not go into depth about the way the debate is going, but rather present the results of a cross-sectional survey at a certain point in time, which we believe will clarify the relationship with such a debate.

Section 2 critically examines previous studies on LAWS-related issues, their approach, and their research methodology. In Sect. 3, after a detailed description of the research design, the working hypotheses are presented. Section 4 describes the results of the study utilizing figures and tables. Section 5 discusses the arguments related to these results. Section 6 concludes the study.

2 Previous studies

2.1 Previous studies on the subject under consideration

There have been various debates regarding the ethics of LAWS, particularly in the form of concerns from ethics: there is an on-going debate as to who should be held responsible when LAWS is involved in atrocities that would normally be described as war crimes [30]. Sparrow argues that holding someone justifiably responsible for deaths that occur during wartime is a necessary condition for a just war under the principles of *jus in bello* ("*Jus in bello*" is one of the principles regarding ethical conduct during war. It is a legal principle that states that combat actions taken during war must be humane and ethical. Martinez and Bouvier [19].) Since this condition cannot be met for deaths caused by LAWS, using such a system in war is unethical. Some researchers believe that LAWS should not be permitted, because moral reasoning cannot be codified, making it impossible for the system to act for the "right" reasons [23].

On the one hand, there are various arguments for and against these claims. The arguments supporting the use of LAWS take the following forms: we must consider whether LAWS are physically instantiated, socially constructed institutions, or genuine agents. If there are conceived as the former, they should be treated like any other problem on collective action. If the latter, LAWS not only are the responsible parties but also should be treated as bearers of rights and benefits [24]. The possibility of "carte blanche" responsibility has been overlooked, and that a person of sufficiently high standing can be assumed to bear responsibility for the actions of an autonomous robotic device, even if that person has no causal connection to those actions except for a prior agreement [6]. In addition, several other arguments have been made, such as not regulating LAWS (on the focus on the targeting process [25]; on why emotional competence cannot be a moral distinction [18]; and on the need for lethality [37]).

On the other hand, some argue the need for strict moral and legal regulations of LAWS. There is a strong argument that humans and AWS cannot coexist in war if the existing international principles are respected, because LAWS lack constitutive symmetry with human combatants [4]. Several

other perspectives have also been studied in depth, as follows: on the reasons for opposing LAWS deployment being the reasons for opposing the delegation of moral autonomy to AI, Purves et al. [23]; on the moral significance of technology to the just war effort [27]; on the disrespectful treatment of human targets in violation of the use-of-force contract between combatants [28]; and on the fact that, compared to LAWS, flesh-and-blood humans should be considered at the level of combat inability [34].

It is also where the need for a human monitoring process has also been discussed [35]. In fact, it is also where countries around the world are competing in reality [12].

Along with these supportive and regulatory arguments regarding LAWS, there has also been a discussion of the implications for foreign policy in general. Increased uncertainty, its impact on diplomacy through its effect on elite beliefs, and capacity for effective use have been specifically raised for consideration [10, 14, 15]. However, there are few discussions based on actual public awareness. This study is important, because it bridges this gap between conceptual discussions and public awareness, which requires a grounded discussion.

2.2 Previous studies on the approach

The relevance of civic consciousness to ethical issues has been a philosophical question in its own light. The basic data in ethics and political philosophy are not observational facts per se, but value judgments which have a different cognitive status from the empirical findings revealed through surveys [20]. For example, suppose that surveys and experiments reveal that most people believe that torturing innocent people is wrong. Does this fact prove that it is wrong to torture innocent people? How crucial would empirical success in proving the former proposition be to a normative proof of the latter? Therein lies the struggle of the empirical approach to verify the ethical proposition itself.

Adam Swift lists three reasons why philosophers should consider people's everyday beliefs ([32]: 349–50). First, public opinion provides food for thought for philosophers. The fact that others, perhaps the majority of others, think this or that way provides grounds for caution to philosophers. Second, public opinion is a constraint on feasibility. The reason why popular belief is important to philosophers is that it indicates how acceptable a society is toward using certain ethical norms to guide their conduct. Third, civic consciousness is itself a component of philosophical analysis. The ethical norms that philosophers seek to justify may be constitutively related to general beliefs themselves.

There is a growing trend in ethics to apply empirical findings in neuroscience and psychology to normative studies. For example, there is a discrepancy between the amount that someone is willing to donate to save a specific individual's life versus saving a statistical human life [29]. Psychological studies on the dual processes of thought have attempted to explain this, as have neuroscience methods using fMRI [11]. Such studies rely on thought experiments involving personal decision-making (such as the trolley problem), but it would be interesting if we could obtain similar empirical results on the thought experiments involving political decision-making, such as the ticking time bomb scenario. This study seeks to widen and develop such a trend in the field of war ethics through a survey of attitudes using experimental methods.

2.3 Previous studies on research methods

Previous studies have examined public attitudes toward both traditionalist (the idea that just combatants and unjust combatants are on the morally equal status under jus in bello) and revisionist (the view that they do not enjoy the same moral status because of the latter's contribution to an unjust war) approaches to the ethics of killing in war [2] as well as the attitudes of the American public toward the moral equality of combatants [26]. Both are scenario-based surveys on the attitudes of a sample of citizens. In the former, the results show that the respondents did not consider the *jus ad bello* legitimacy of war to be irrelevant to the *jus in bello* judgments, a result that is consistent with the revisionist approach. The latter demonstrated that a larger percentage of respondents judged soldiers who participated in an unjust war to be ethically inferior to those who participated in a just war (even if their behaviors on the battlefield were the same) and that they supported harsher punishments for soldiers on the unjust side. In these studies, the surveys take the form of presenting a hypothetical scenario to a sample of citizens and asking them to choose the option of making any decision under certain conditions.

The most relevant previous study here is a survey that compiled moral values regarding LAWS [36]. This study reviewed the various definitions of LAWS currently used in the literature and identified several values that people associate with LAWS: blame, trust, harm, human dignity, trust, expectation, support, fairness, and anxiety. Scenarios describing military operations were created and attitudes were surveyed, first for a sample of military personnel and second for a sample of civilians, as a means of studying moral judgments in a randomized experiment. The scenario involves a convoy delivering supplies in a war zone. A vehicle approaches the convoy at high speed. This is a situation that is likely to occur in this type of operation. A small number of military personnel and civilians have insight into the current technology of human-controlled drones, the future technology of LAWS, and how they perceive their use. The results shows that they are more concerned about using LAWS than using human-controlled drones, and that the actions of human-controlled drones and LAWS are seen

to cause just as much damage and are seen as equally fair. The implication is that human dignity and insecurity are values often mentioned in the public sphere, and that it is essential to address these values when discussing the ethics of using LAWS.

This study is extremely significant as an empirical study that supports certain opinions expressed in the political debate about LAWS, demonstrating that there is more anxiety about the use of LAWS than about the use of human-controlled drones, because LAWS are perceived as having less respect for the dignity of human life. The findings reveal a common ground regarding the moral value of human dignity and the apprehension associated with the use of LAWS. Nonetheless, the study is limited due to difficulties in reproducibility and internal validity because anxiety is an emotion, not a moral value, and the study is based on heuristics derived from a classification of literature describing values. Other technical difficulties include the constant inclusion of civilian deaths in the scenarios, which leads to the difficulty of confirming awareness on the expectation to reduce civilian deaths in the LAWS discussion, as well as the 101-level grading of anxiety values, which is too detailed and beyond the realm of expressing citizen perceptions. The survey was also not structured to collect questions and answers on an individual basis, making it impossible to examine the structure of the survey. For example, it was hard to confirm whether or not respondents to one question were giving specific answers to another question.

To address these difficulties, we conducted research to collect questions and answers that focus more on today's main ethical issues of LAWS, such as the possibility of reducing civilian deaths, comparison with remote weapons, the difference between awareness of a just war and perception of reality, and approaching dignity through structured questions.

As is the case with prior surveys, these surveys are preliminary attitude surveys on technologies that do not yet exist, and bias may be inherent in the overall attitude toward new technologies. Nevertheless, we think that they have certain significance in that they investigate the distribution of awareness at the time of the survey among those who have understood the definitions.

3 Research methodology

3.1 Overview of methodology

The following sample was used to examine scenario-based public awareness regarding LAWS. Power calculations were performed with respect to the participants required for the study. With a population size of 123.4 million (the population of Japan), a confidence level of 95%, and an acceptable margin of error of 0.05, a target of 385 respondents was set. In addition, questions were set to assess data quality with particular reference to the latest research findings on the quality of data collected online.

We see no reason to consider any particular bias, since the population of those who participated without having a particular assumptions on LAWS was consequently distributed similarly to the standard population distribution. This point of statistical validity is one important factor that makes randomized controlled experiments adapted in this study possible.

The survey was distributed via QIQUMO's online survey platform and received 1200 responses, of which 445 were accepted after a check on data quality. The descriptive statistics of the respondents are presented in Appendix Table 1.

While clearly stating that Japan is chosen as the focus of this study for the sake of convenience, it should also be noted that Japan is a developed country, not in conflict (or near conflict), known for its familiarity with high technology, and widely general in nature as a standard human sample. While Verdiesen et al. [36], surveyed only Dutch people, it is likely that a survey of Japan, a non-Western country, could be conducted a purer survey of attitudes toward humans versus artifacts (for Western Bias in conflict studies, see Ref. [22]). In light of studies that suggest that the quality of responses to online surveys is not high, this number of responses is the result of collecting only those who appropriately responded to the questions about their understanding of LAWS and their efforts to complete the online survey [38].

3.2 Randomized controlled experiment

The method we used to conduct this study is called a randomized controlled experiment, similar to the study by Verdiesen et al. [36]. Oehlert [21] offers four reasons for creating such an experiment: (1) it allows direct comparisons between treatments of interest, (2) it can be designed to minimize comparison bias, (3) it can be designed to minimize comparison error, and (4) it allows us to control the experiment, thus allowing us to make stronger inferences about the nature of the differences we observe, especially about causal relationships. This last point particularly distinguishes the experimental approach from observational studies. Treatments in this sense are defined as the various treatments we intend to compare. We use randomization in our studies to vary the order of the scenarios and questions posed to the respondents in a probabilistic way.

In addition, dummy questions were prepared and respondents who clearly did not understand the definition of LAWS or the contextual setting (including those who responded automatically or by playing games) were eliminated beforehand. Based on the quality of data collected online, 445 out of 1200 responses were analyzed.

3.3 Scenarios

Scenarios are used in cognitive science as a means to study moral judgments in randomized experiments [7, 17]. We created scenarios describing military operations and their outcomes, which facilitate the expression of awareness about ethical issues by LAWS (Scenario description: full text in Appendix).

In the near future (within the next 10 years), Countries A and B are at war. You are a decision-maker in Country A. A battle is taking place in an urban part of Country B. You must decide whether to order your soldiers to engage in battle or to use LAWS.

If you do not use LAWS, the battle will cause the casualties of 10 combatants from Country A, 100 combatants from Country B, and 100 civilians from Country B.

If LAWS are used, there will be 0 casualties from Country A and 100 casualties total from Country B.

Since this scenario focuses specifically on the use of LAWS into combat, LAWS is defined as the autonomous targeting of targets and lethal attacks without human involvement. The explanation reminds the participants that it is a weapon that selects and attacks its own targets. In doing so, it also explains that monetary issues, such as cost and damage, are not considered here. We believe that this makes it possible to identify and investigate only whether or not LAWS are ethically permitted to be used in combat.

In addition, a similar scenario (Scenario 2) was prepared that replaced LAWS with remote weapons, as well as a scenario (Scenario 3) replacing Country A with the home country (in this case, "Japan," as the survey was conducted in Japan). Each participant had to make a decision for all three scenarios, and their responses were collected. Self-defense here refers to actions or combat that one would take to defend one's country against an attack on one's country.

Such scenarios may be perceived as too abstract and artificial. Of course, the contexts for the use of LAWS in real international conflicts are complex, and the considerations to be made range from legal, technical, and tactical issues to national and international public opinion. On the other hand, thought experiments used in ethics and political philosophy to test the validity of moral principles, such as the trolley problem, use simplified, idealized, and anonymous situational settings. As indicated in Sect. 2.2, the aim of this paper is not so much to analyze the moral validity of the use of LAWS in the context of concrete international conflicts, but rather to analyze the content and tendencies of people's ethical thinking about the validity of the use of LAWS per se. For this reason, this study offers scenarios that avoid specific situational settings.

3.4 Propositions to be verified

The following five working hypotheses are assumed.

(i) LAWS are unlikely to be used.
  Based on previous studies, it is expected that more people will choose not to use LAWS, because intervention based on human judgment is deemed more trustworthy and preserves dignity.

(ii) Civilian casualties (number of casualties) have a greater influence on the decision to use LAWS than combatant casualties.
  Those who believe that the number of civilian casualties will increase will hesitate to use LAWS, while those who believe that the number will decrease will be more willing to use LAWS. Stated differently, the main reason for using LAWS is to reduce the number of civilian casualties.

(iii) Remote weapons are more likely to be used than LAWS.
  Weapons with human judgment are less aversive than weapons without human judgment. In particular, since the question focuses on whether the weapon is a LAWS or not, the presence or absence of human judgment is considered important from an ethical standpoint.

(iv) LAWS are more likely to be used in homeland defense.
  This survey was explicitly designed to be a survey of public awareness regarding the ethics of LAWS use. Therefore, it is presumed that people are aware of ethical viewpoints and are hesitant to use LAWS in a hypothetical situation with a third country. However, in situations where LAWS are used in homeland defense (Homeland defense refers to actions or fighting to protect one's own country from attack in the event of an attack), a sense of self-defense and a clear distinction between in-groups (domestic people) and out-groups (other country people) are expected to outweigh the sense of aversion to LAWS.

(v) Males and younger respondents are more willing to use LAWS.
  The characteristics of LAWS are considered to be generally unfamiliar to the general public, while male and young people are generally more interested in advanced and unlike any known technology [9]. As such, they would generally be less averse to the existence and use of LAWS.

4 Results

4.1 Are LAWS less likely to be used?

Hypothesis (i) is tested by a direct question. The results show the exact opposite of Hypothesis (i). The result contradicts the results of Verdiesen et al. [36] that LAWS are less likely to be used (see also Fig. 1).

More respondents answered that they would use LAWS. The null hypothesis that the likelihood of more respondents choosing to use LAWS than those choosing not to use LAWS is irrelevant is not rejected at the 5% one-sided level, but is rejected at the 10% level (Table 1).

4.2 Whether civilian casualties (number) rather than combatant casualties affect LAWS use

Hypothesis (ii) relates to whether respondents who believe that using LAWS will reduce civilian casualties are okay to use LAWS in response to the following question (Tables 2 and 3).

The proportion of respondents who answered that they would use LAWS was particularly high among those who believed that using LAWS would reduce Country B civilian casualties. The null hypothesis that there is no association at all between those who chose "will reduce" and those who chose "will use LAWS" is rejected at the 99% level.

4.3 Remote weapons are more likely to be used than LAWS

In a study by Verdiesen et al. [36], weapons with human judgment were less aversive than weapons without human judgment. Based on this, the individual questions are specifically asked with an explicit focus on whether or not the question is about LAWS. Remote weapons are more likely to be used,
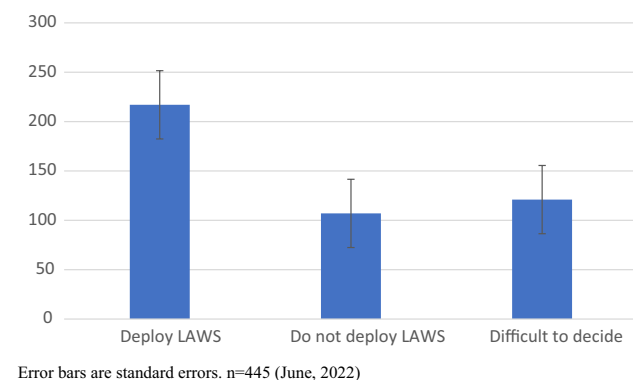
Table 1 What decision would you make about using LAWS?

	Number of selected	Percentage (%)
I would use LAWS	217	48.8
I would not use LAWS	107	24.0
It is difficult to decide	121	27.2

because the presence of human judgment is considered important from an ethical standpoint (Table 4).

More respondents (in percentage) chose to use remote weapons than LAWS. However, the difference is not significant (see also Fig. 2).

4.4 LAWS are used in homeland defense

In situations where LAWS are used in homeland defense, a sense of self-defense and a clear distinction between in-groups and out-groups are expected to outweigh the sense of aversion to LAWS (Table 5).

More respondents answered that they would use LAWS in homeland defense than hypothetical other countries, although the difference is not considered significant (see also Fig. 3).

4.5 Male and younger respondents are more willing to use LAWS

The characteristics of LAWS are considered to be generally unfamiliar to the general public, while male and young people are generally more interested in high-tech technology. As such, they would generally be less averse to the existence and use of LAWS. To demonstrate this, we use the following logit-type estimation equation to estimate the relationship between the attributes of those who choose to use LAWS:

$$\text{logit} law_i = \alpha + \sum \beta_j x_i + \varepsilon_i,$$

where i represents each respondent, j is a subscript representing each attribute, and law is a dummy variable indicating

300

250

200

150

100

50

0

Deploy LAWS   Do not deploy LAWS   Difficult to decide

Error bars are standard errors. n=445 (June, 2022)

Fig. 1 Use of LAWS

Table 2 Do you think that using LAWS will increase or reduce civilian casualties in Country B?
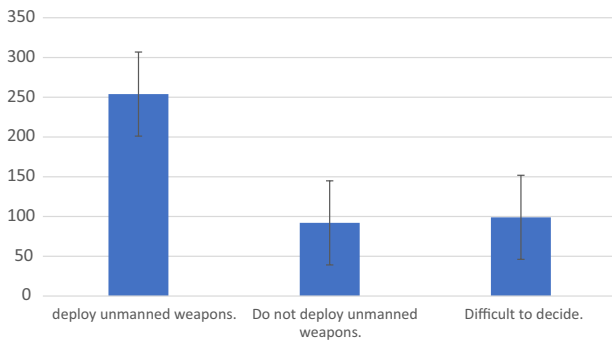
	Number of selected	Percentage (%)
I believe that using LAWS will increase Country B civilian casualties	165	37.1
I believe that using LAWS will reduce Country B civilian casualties	153	34.4
It is difficult to decide	127	28.5

Table 3 Relationship between views on the increase or decrease in the number of Country B civilian casualties and the decision to use LAWS

	I believe that using LAWS will increase Country B civilian casualties	I believe that using LAWS will reduce Country B civilian casualties	It is difficult to decide	Total
I would use LAWS	68	119	30	217
I would not use LAWS	65	12	30	107
It is difficult to decide	32	22	67	121
Total	165	153	127	445

Table 4 What decision would you make about using unmanned weapons?

	Number of selected	Percentage (%)
I would use unmanned weapons	254	57.1
I would not use unmanned weapons	92	20.7
It is difficult to decide	99	22.2

Error bars are standard errors. n=445 (June, 2022)

Fig. 2 Use of unmanned weapons

Table 5 What decision would you make about using LAWS?

	Number of selected	Percentage (%)
I would use LAWS	260	58.4
I would not use LAWS	88	19.8
It is difficult to decide	97	21.8

Error bars are standard errors. n=445 (June, 2022)

Fig. 3 Use of LAWS in one's own country

Table 6 Attributes and LAWS

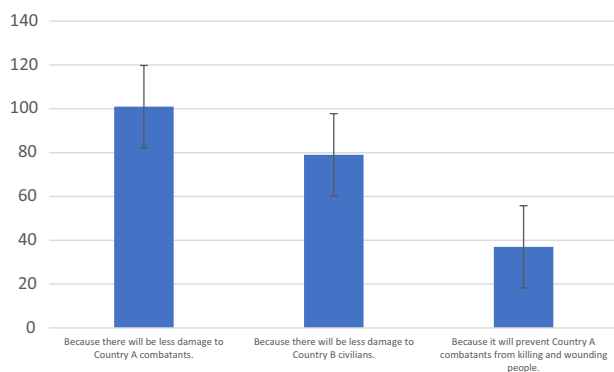| Dependent variable:	LAW
Method: ML—Binary Logit (Newton–Raphson/Marquardt steps)	
	Coefficient (Std. Error)
α	0.999 (0.6220)
βsex	− 0.816*** (0.1959)
βage	− 0.027 (0.0238)
βage*age	0.000 (0.0002)
$n = 445$	
McFadden R-squared	0.033
Akaike info criterion	1.360

According to the results, males are more likely to choose to use LAWS. This is largely independent of age and age squared. Therefore, while males were indeed more likely to use LAWS, no relationship with age could be found.

5 Discussion

The results obtained here can be briefly summarized as follows. (1) Hypothesis (i), which proposes that LAWS are less likely to be used could not be verified, and in fact, the opposite tendency was observed. (2) Hypothesis (ii) that civilian casualties (rather than combatant casualties) would strongly

the choice about LAWS use, which takes the value 1 if the respondent chooses to use LAWS and 0 otherwise. x is a variable representing attributes, which takes the value 1 for female and 0 for male for gender, and a numerical value for age. For age, a squared term is also considered, assuming a non-linear relationship. ε is the error term. The variables to be considered are α (constant term), βsex, βage, and βage*age (Table 6).

Table 7 Which of the following is your reason for using LAWS?

	Number of selected	Percentage (%)
Because there will be less damage to Country A combatants	101	46.5
Because there will be less damage to Country B civilians	79	36.4
Because it will prevent Country A combatants from killing and wounding people	37	17.1

Error bars are standard errors. n=217 (June, 2022)

Fig. 4 Reasons for use of LAWS

Table 8 Which of the following is your reason for not using LAWS?

	Number of selected	Percentage (%)
Because it is against human dignity for machines to kill and injure humans	51	48.6
Because machines cannot be held responsible for misfires or accidental shootings	31	29.5
Because it is illegal	5	4.8
Because of the possibility of technical failure	13	12.4
It was difficult to decide	7	6.7

influence LAWS use was strongly and significantly confirmed. (3) Hypothesis (iii) that remote weapons were more likely to be used than LAWS could not be confirmed, but there was no significant difference. (4) Hypothesis (iv) that LAWS would be used in defense of the homeland did not reach significance, but a trend was observed. (5) Hypothesis (v) that male and younger persons are more willing to use LAWS was strongly and significantly confirmed for male, but not for age.

In the 2019 survey, military personnel from the Dutch Ministry of Defense perceived human-controlled drones as more respectful of human dignity than the future technology of LAWS, while civilian respondents did not see a significant difference among them [36]. Although not directly comparable to these results, the empirical results of this survey do partially represent the current views and opinions on LAWS based on subsequent technological advances and press attitudes. Many perceive LAWS as having the potential to reduce civilian casualties and are willing to use them. However, there was no significant difference in the percentage of respondents between the two questions on LAWS and remote weapons, although more respondents chose to use remote weapons.

On the one hand, those who decided to use LAWS mostly chose "because there will be less damage to Country A combatants," but the difference was not significant (see Table 7 and Fig. 4). On the other hand, the most common reason given for not using LAWS was that it was against human dignity for machines to kill and injure humans, and the difference between this and other reasons was significant (see Table 8 and Fig. 5).

As mentioned earlier, this study attempts to bridge the gap in empirical and philosophical research through a survey of attitudes using experimental methods. The findings of this study confirm that the issues that philosophers have addressed regarding the legitimacy of LAWS are in fact also important in the public consciousness. For example, some philosophers have argued that the use of LAWS should not be allowed, because it is undignified to be killed by machines instead of humans [16, 31]. The survey conducted by this study also confirmed that the issue of dignity is a strong negative decision-making factor for citizens.

This implies that improving citizen perceptions of the use of LAWS would require addressing the issue of human dignity. In terms of feasibility, where combatant casualties are considered more serious than civilian casualties, it is necessary to discuss the tendency that direct damage reduction is considered more important than a mere abstract ethical adequacy.

In addition, a certain number of people are hesitant to use LAWS even for homeland defense. Female was more likely to be hesitant, those who chose not to use in a third country, and those who chose not to use remote weapons. Their perception is most often based on the reason that it is against human dignity for machines to kill and injure humans. This perception of citizens is not directly based on the previously discussed perspectives such as the possibility of pursuing

Fig. 5 Reasons for not using LAWS. Error bars are standard errors. $n = 107$ (June, 2022)
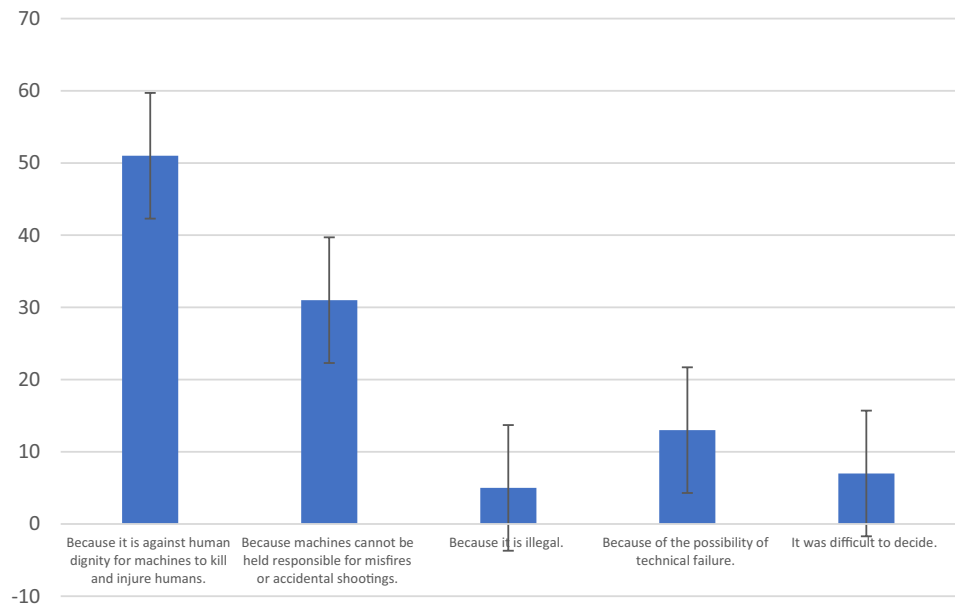
Error bars are standard errors. n=107 (June, 2022)

responsibility, the possibility of codifying moral reasoning, and the possibility of lowering the sense of responsibility and morality. Therefore, if one of the aims of the discussion is to explore the conditions for the acceptable use of LAWS, it is necessary to examine the ways in which human dignity can be secured. Furthermore, it is necessary to proceed with the discussion of the ethics of LAWS, bearing in mind that not only civilian casualties but also combatant casualties carry equal or greater weight in the perception of citizens, and that the same type of recognition is given to them in the case of remote weapons with no major differences between home country and other countries.

The insights gained here can be seen to differ from the discussion in Skerker et al. [28]. The argument there is that artificial agents called LAWS cannot understand the value of human life. Human combatants cannot transfer to robots the privilege of targeting enemy combatants. Thus, the human duty-holder who uses LAWS is violating the martial contract between human combatants and disrespecting the targeted combatants. In response to this deontological objection, the results of this study, namely that citizens do in fact choose to use LAWS and do not recognize the difference between them and remote weapons, may call for a reorientation of the debate in ethical research.

A clues for this direction of future research can be found in Danaher and Sætra [8]. In the discussion, technology changes the costs and benefits of accessing these values and allows these values to be replaced by other closely related values. In addition, technology is changing these values by increasing the perception of scarcity and abundance and by disrupting the gatekeepers of traditional values. This allows citizens to believe that LAWS is a "reliable" means of achieving "truth," thereby rendering the deontological objection as a conventional value in academia merely an argument that is idle from civic consciousness. Therefore, it can be pointed out that even in terms of ethical research, the debate must be based on the extent to which citizens are aware of the realities of technology.

In addition to this, there is a need for the so-called pre-emptive discussions. Much of the current discussion is "pre-implementation" and may be delayed by political and military realities. States and non-state groups are actively pursuing the possibility of deploying such systems on the battlefield; only when LAWS reach a point where they can be more discriminating in their target selection and more proportional in their threat response will the innocent on the battlefield use LAWS instead of human soldiers. The argument is that they have a right to insist on using LAWS and to not be unjustly harmed by both combatants [5]. This study confirms citizen perceptions of technology. It is then necessary to present the technological reality to citizens along with the direction of the technology to discuss policies to avoid avoidable situations.

A study of public attitudes toward LAWS would have the following significance. With regard to ethical implications, LAWS are weapons that operate without human intervention and have the potential to change the nature of war. This research can help clarify how the public perceives the use of such weapons and inform ethical debate and policymaking.

Regarding implications for accountability, public awareness of LAWS is crucial to holding governments and military organizations accountable for their use. This study

provides insight into whether the public understands the potential consequences of LAWS use and supports its use.

Regarding clarifying public opinion, such a study can also provide insight into public opinion regarding the use of LAWS at this time. Understanding the public's opinion of such weapons is important, because it can help policymakers in their actual decision-making and in the discussions leading up to it.

Regarding the implications for perceptions themselves, it is also significant that conducting this study will also serve as a tool to raise awareness about LAWS and its implications. The more people are aware of LAWS, the more informed public debate can be, and the more likely people will be to engage in this topic.

However, the survey of public attitudes on foreign policy differs from the survey of public attitudes on LAWS in the following ways:

Regarding the complexity and breadth of the issues, foreign policy is a broad and complex field encompassing a variety of issues, including trade, diplomacy, defense, and humanitarian assistance. LAWS, on the other hand, is a more specific and narrow issue that requires a certain level of knowledge to understand. Therefore, we believe that a survey of public attitudes about LAWS will be more focused, more nuanced, and more deeply related to ethics than a survey of public attitudes about foreign policy.

Regarding emotional engagement, LAWS is a controversial and emotional issue because of its potential to harm innocent people and change the nature of war. In contrast, public attitudes toward foreign policy tend to be less emotional and more pragmatic. Therefore, surveys on LAWS are likely to generate stronger public opinions and reactions than those on foreign policy.

Given these arguments, we believe that a study examining public attitudes about LAWS would be significant, because it would provide important insights into the ethical, philosophical, and social implications of the use of these weapons and could inform policy and public discourse on the subject.

6 Conclusion

This study examined public attitudes toward LAWS and filled the gap between ethical research and empirical evidence. Based on the quality of data collected online, 445 out of 1200 responses were analyzed. A randomized controlled experiment similar to the study by Verdiesen et al. [36] was conducted. A scenario describing military operations and their consequences, which facilitated the expression of awareness of ethical issues by LAWS, was created and presented, and responses were collected. Hypothesis (i) was rejected. Hypothesis (ii) that civilian casualties (number) rather than combatant casualties

would influence LAWS use was strongly and significantly confirmed. Hypothesis (iii) that remote weapons are more likely to be used than LAWS was not confirmed, and there was little difference in attitudes toward their use. There was some support for Hypothesis (iv) that LAWS are more likely to be used in homeland defense. Hypothesis (v) that male and younger people are more willing to use LAWS was strongly and significantly confirmed for male, but not for age. In terms of the impact of citizen perception on the use of LAWS on the debate, it is necessary to consider the fact that human dignity was one reason for not using LAWS. In terms of feasibility, where combatant casualties are considered more important than civilian casualties in the reasons for using LAWS, it is necessary to discuss the tendency that direct damage reduction is considered more important than a mere abstract ethical adequacy.

The significance and implication of this study is that it managed to bridge the gap between ethical research and public awareness given the lack of such prior studies. It also found that public awareness, which had previously been negative toward LAWS use, now tends to be rather positive. In addition, the study revealed that both the reduction of civilian and combatant casualties is an important point to be considered (and may have more weight) in LAWS use. Another reason against the use of LAWS was a strong awareness that it is against human dignity for machines to kill and wound humans. This is a point that needs to be presented and considered in future ethical research. Furthermore, this study identified what needs to be addressed and reconsidered technologically and politically. The position of this study within AI and Ethics is to confirm that the on-going debate in the broader context of ethics and technology is based on people's awareness, divergence, and interactions. The contribution and implication of the results of this study is that it reveals that public awareness, which was previously negative toward LAWS input, now tends to be rather positive.

The main limitation of this study is that it only surveyed civilian attitudes. In other words, it is important to examine the perceptions of different demographics, such as researchers, military personnel, and politicians, and to analyze the background and effects of these perceptions. In addition, although the survey revealed different results from those of a previous study conducted in the Netherlands, it is conceivable that surveys could be conducted in other major countries such as the United States.

Data availability The request for data access will be considered on a case-by-case basis, and approval will be granted only after a thorough evaluation of the request and confirmation of the requester's qualifications and intentions. The data will be provided in a secure and anonymized form to ensure the confidentiality of the individuals and organizations involved in the research.

Declarations

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