

Reconsidering the concept of ‘dual-use’ in the context of neuroscience research

COMMENTAIRE / COMMENTARY

Nathalie Voarino¹

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Résumé

Le concept de « double usage » réfère habituellement aux recherches ayant des applications à la fois civiles (par exemple, thérapeutiques) et militaires. J'avance que cette dichotomie peut et devrait être reconsidérée et qu'ainsi le concept de double usage pourra aider à faire l'examen d'autres potentiels mésusages, comme la neuroamélioration ou le neuromarketing.

Mots clés

double usage, neuroscience, neuroéthique

Summary

The concept of ‘dual-use’ research usually refers to research with both civilian (e.g., therapeutic) and military applications. I argue here that this dichotomy can and should be reconsidered and thus that the concept of dual-use can be helpful in examining other potential misuses, such as neuroenhancement or neuromarketing.

Keywords

dual-use, neuroscience, neuroethics

Affiliations des auteurs / Author Affiliations

¹ Programmes de bioéthique, Département de médecine sociale et préventive, École de santé publique de l'Université de Montréal, Montréal (Québec) Canada

Correspondance / Correspondence

Nathalie Voarino, nathalie.voarino@umontreal.ca

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Conflicts of Interest

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Introduction

The concept of ‘dual-use’ has been used primarily to address the security implications of knowledge and technology that can be used for both civilian and military applications, notably with regards to advances in data encryption, nuclear physics and biomedicine [1]. The concept points to issues of shared responsibility (e.g., of scientists, industry, government) in the context where well-intentioned research can produce useful knowledge and beneficial technologies but which can also be misused [2,3], and thus calls for precautionary measures to predict and prevent the problematic effects of such research [1]. A broader definition of ‘dual-use’ would thus include “research that leads (or might be expected to lead) to the generation of information and/or technology that can be used for both good and bad purposes” [1]. The resulting ethical challenges often present as a conflict between the promotion of public security and the progress of science [3], with the dilemma of, on the one hand, respecting academic freedom and supporting the advancement of knowledge, while on the other hand, regulating certain avenues of research and technology development in order to prevent or mitigate the risks associated with potential misuse [4].

This concept has been applied to various fields, most recently regarding the misuse of virology and genomics research [1] by non-state actors (e.g., terrorist groups) seeking to develop various forms of biological weapons (e.g., high toxicity pathogens [4]) with a view to engaging in bioterrorism. Dual-use has also been applied to the neurosciences, even if the risks associated with misuse in this field are not currently considered as important as the security implications raised by the use of biological agents for bioterrorism. It is commonly recognized that “much neuroscience is ‘dual use’ research, asking questions and developing technologies that are of both military and civilian interest” [5]. Preoccupations about the use of cognitive sciences for national security purposes clearly predates the neurosciences, going back to at least World War II [7] with regards to the implications raised by the field of psychology. For example, the American Psychological Association (APA) has been active in trying to limit the misuse of psychological knowledge and tools when used to meet national security objectives (e.g., with regards to confidentiality, informed consent, return to combat of a service member with a mental disorder, or enhance interrogation techniques) [7,8].

In recent years, defense and national security agencies have increasingly funded neuroscience research on brain computer interfaces (BCIs) and neuropharmacology [5,6]. These areas of research raise interesting perspectives for neuroenhancements that could improve the performance of soldiers and support defense strategies. It is broadly recognized in the dual-use literature that military use is not a misuse per se [4], because military applications might have significant and legitimate benefits for national security and the safety of soldiers, thus the harmful nature of military applications is somewhat tempered. Nevertheless, ethical issues associated with military applications of neuroscience are numerous. Moreover, many potential misuses do not involve the development of neurotechnologies for military purposes and still present a distorted use of original research objectives. A notable example is the use of neuroscience research by the private sector to develop and refine targeted neuromarketing to consumers. To narrow the scope of reflection to only those studies that could be associated with military applications, or to those linked to bioterrorism, would be to neglect other areas of neuroscience that are potentially beneficial and also risky (e.g., in the public and private sectors) and that warrant ethical consideration. In this paper, I argue that the concept of dual-use can and should support nuanced analyses of the ethical challenges raised by a full range of neuroscience research, whether this knowledge is used for military applications or in civilian contexts by governments or the private sector.

Evident dual-use research in the neurosciences

As already mentioned, the dual-use nature of research in neuroscience often leads one to the idea of potential therapeutic uses being misused for military purposes, as evidenced by the interest of defense and national security agencies in funding research in the field. To name but one example, the US Defense Advanced Research Projects Agency (DARPA), which financed some of the first BCI studies [6], supports projects on neuroenhancement – many of which are unclassified studies conducted by university researchers [9] – ranging from neuropharmacology to BCIs or BBI (Brain to Brain interface). For an example of the broad dual-use implications, research on Post-traumatic Stress Disorder (PTSD) has revealed that the use of Propranolol, especially after an accident – whether in the military or civil context – could reduce the occurrence of this condition. However, there is also concern about the potential misuse of this drug which could allow people to carry out violent acts without any memory of the act, or without any associated regret or guilt; such a potential for misuse should thus add additional considerations to the relatively commonplace use of Propranolol to treat minor stress [10]. Similarly, research on narcolepsy has led to the use of Provigil (modafinil) in the treatment of sleep disorders, a drug that is now also being used to increase soldiers’ wakefulness and decrease fatigue [10].

The BCI technologies, which have come in to use only relatively recently, have some promising therapeutic perspectives, particularly for the treatment of severely disabled patients (e.g., locked-in

syndrome or quadriplegia), but also for less severe conditions in the near future [11]. The BCIs are also potentially a means to remotely control the actions of soldiers or to increase their abilities (e.g., strength or endurance) [5]. For example, DARPA's AugCog program led to the development of the "cognitive cockpit", which allows an integrated heads-up display to maximize but also simplify information management [5]. Finally, the very recent emergence of BBI technologies allows direct communication between two brains [6]; studies have observed transmission of sensorimotor information between two rat brains [12], and from a human brain to a rat brain [13]. Ongoing research aims to develop and refine this type of communication, notably between human brains, and the military will surely be among the first users [6]. Non-military uses of BBI could include enhancing learning and cognition in general, and in both school and university contexts [6].

In addition to questions concerning the validity of current studies and the long-term (side) effects associated with the use of BCI and BBI technologies [6], there are clearly important ethical concerns associated with both military and civilian use of these technologies. The use of these technologies in the military context raises questions about the autonomy of soldiers and their ability to freely accept or reject such 'enhancements' [5], and the risk of coercion if these technologies become a means to directly interact with and alter or control a soldier's brain functions, which then raises the question of personal responsibility [6]. In addition, BCI and BBI technologies could contribute to a further psychological distancing between the parties involved in combat operations, negating the visceral nature of combat that links a soldier's actions and their consequences [5], thus undermining ethical decision-making, something that has already been observed in the use of aerial drones [14]. For some, the use of BCI and BBI technologies outside the therapeutic context violates individual authenticity, does not respect the limits of nature, and puts people at risk of losing what makes them human [6], with a possible risk of sliding towards social systems of domination and manipulation [15]. Given the imminent developments in the neurosciences, and the associated risks, the importance of focusing on dual-use concerns should be evident.

Reconsidering the dual-use of neuroscience research

It is important to reconsider the 'harmful' labelling by default that has come to be associated with the use of neuroscience and neurotechnologies in military applications and national defense. As already mentioned, many neuroscientific applications could be justified in this context in order to maintain a certain military superiority, to make operations more efficient and safe, and to be able to anticipate and counter the potential offensive moves of an adversary [16]. Further, there are examples of dual-use research that could be potentially beneficial (and justifiable) for national security purposes, but potentially harmful when moved into civilian applications [16]. The development of technologies such as Brain scanning and Brain fingerprinting could be very useful for improving investigations and interrogations [5], but the fear, in part, concerns the accuracy and reliability of information provided by such technologies (e.g., premature use for lie detection) [17]. Similar concerns have already been observed in the context of the involvement of psychologists in interrogations, and have led different professional associations – through their codes of ethics – to limit the implication of their members in such practices, although a total prohibition is still being debated [8]. It is thus appropriate to consider the role of neuroscience in this context.

The development of 'neurojustice' would necessarily require consideration of respect for individual privacy, confidentiality, moral integrity and human dignity [15,18]. Without proper constraints, the use of these methods could lead to a dehumanized practice of justice that disregards fundamental human rights [18]. And these risks seem even less acceptable in the case of civilian uses of such technology. However, while the labelling of innovations as 'dual-use' usually refers to research that can produce more harm than good [4] – which is particularly evident in cases such as neurojustice where there are threats to public health or security, and very high risks for civil liberties – it also is helpful to use the concept to frame lower level risks.

Indeed, there is potential for the misuse of neuroscience that is completely unrelated to national security or military applications, but is nonetheless problematic. For example, studies into the neuroenhancement (e.g., BCI, BBI, neuropharmacology) of healthy subjects (e.g., to improve performance or lifestyle, instead of for treating illness or disability) could lead to potentially problematic use in the general population. Evident concerns include undermining the autonomy of individuals (an implicit coercion towards the imperative of productivity in a competitive society) and social justice (if access to these technologies is restricted to a limited category of people) [15]. In addition, an emerging neuromania facilitates the use of popularised presentations of neuroscience research by many disciplines to increase their perceived credibility or validity, which is ethically questionable and may lead to potential misuses [19].

One notable example is neuromarketing research, or research in neuroeconomics that could inform neuromarketing. Neuromarketing is a new discipline that uses medical neurotechnology to study brain responses to marketing stimuli [20] and to solve business goals [21]. Although neuromarketing faces many methodological limits and its applications are still preliminary [20], it appears likely that research in this area will provide new means to adapt commercial marketing strategies to respond to (and to shape) the desires of individual consumers [21]. The question of the manipulative potential of such techniques arises along with the imbalance in the power between the buyer and seller [20]. Key concerns include the potential for infringing the liberty of individuals to freely choose when they are exposed to neuromarketing that creates a false sense of confidence and self-determination, and undermines the ability to recognize that they are being subject to directive or even manipulative marketing techniques [22]. Although marketing has long used various techniques to influence consumers [22,23], including concepts and methods of cognitive and social psychology and communication sciences [22], the concern here is that neuromarketing uses methods that consumers cannot identify and thus escapes their control. That is, by providing potentially very effective means of brain manipulation, marketers could provoke desired behaviours without consumers being aware (or even being able to be aware) that they are being manipulated [22,23].

Conclusions

If the development of neurotechnology applications for military or national security purposes may be considered a potentially harmful use of neuroscience research in light of the resulting ethical risks, this should not be seen solely as misuse, nor as the only example of dual-use research in neuroscience. Ethical risks associated with other potential applications of neuroscience research, although often of a different nature or magnitude, reveal other potential misuses that expose concerns similar to those of research with explicitly military applications. The use of the concept of dual-use could help to better identify the diversity of potentially beneficial and problematic uses of neuroscience research in general and would, I suggest, facilitate neuroethics reflection on the ethical implications and associated responsibilities of the different actors involved.

However, the use of the dual-use concept should not be limited to creating a simple dichotomy between the potentially beneficial and potentially harmful uses of neuroscience research and technology; it should instead be integrated with neuroethics reflection about particular practices and applications, in a context-specific perspective that takes into account the different levels of risk presented by such research, for the different actors involved. This concept can also be very useful for evaluating the level of responsibility that should be attributed to different actors, and that arises from the potentially beneficial and problematic uses of each technology. The concept should be used with the goal of putting in place a range of different governance mechanisms (e.g., scientific critique, government regulation, public oversight) that can anticipate as much as possible the potential applications in order to be proactive and not simply reactive once the harms have occurred [24].

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