

A Note on the Definition of “Dual Use”

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Received: 24 February 2009 / Accepted: 21 July 2009 / Published online: 14 August 2009
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Abstract While there has been much interest in this topic, no generally accepted definition of dual use has been forthcoming. As a contribution to this issue, it is maintained that three related kinds of things comprise the category of dual use: research, technologies and artefacts. In regard to all three kinds, difficulties are identified in making clear distinctions between those that are and are not dual use. It is suggested that our classification should take account of actual capacities and willingness to make use of these objects for ‘bad ends’ and not the mere possibility that this could be done, and here three ‘contextual factors’ are identified. A (provisional) definition is proposed that takes account of threats and risks.

Keywords Dual-use · Research and development · Technology · Harmful uses of research and technology · Improvised and purpose-built weapons · Threat · Risk

Dual use has been the topic of a number of recent discussions, in this journal and elsewhere. The general idea is that a technology, say, has an intended use or primary purpose which is good (or at least not bad) and a secondary purpose or use which is bad and is not intended by those who developed the technology in the first place. This is supposed to raise, or should raise, moral problems for researchers, for instance about responsibility, and it raises administrative problems, for example about controls on the transfer or development of technologies.¹ However, David

¹ Of course, many researchers carry on their work blissfully unaware of any moral issues their research might engender. Readers of this journal will deplore that attitude.

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Resnik has claimed that these discussions lack a definition of dual use that is not so narrow as to exclude matters of real concern and not too wide as to make the exercise of control unmanageable (Resnik 2009). Having made his point and stated his criterion for a good definition, Resnik leaves the field for others to take up the challenge. My aim is to identify the kinds of items that we need to include in the category of dual use, the relations between them, and some considerations that we should take into account in order to circumscribe the category.

But just which members of these kinds should be included in the category seems to defy any characterisation that seeks to abstract from specific contexts and values. I will assume that membership of the category of dual use means that the items in question need to be regulated in some way and that scientists and engineers working on them need to be aware of their responsibilities. However, I will not address any specific issues about how regulations are to be put in place, or how scientists are to be encouraged to be responsible for their work.

Dual Use Knowledge

One of the difficulties in giving a workable definition of dual use could be because the term is used to qualify different and seemingly unrelated sorts of things, technology, research, experiment and products or artefacts. For instance, the term “dual-use” was explicitly used at least as long ago as 1993, when it appeared at the very beginning of a report by the US Office of Technology Assessment (OTA 1993) on the technologies underlying weapons of mass destruction and these products themselves. “Understanding the extent to which ‘dual-use’ technologies or products—those also having legitimate applications—are involved in the development of weapons of mass destruction is important, since both the feasibility of controlling dual-use items and the implications of doing so depend on the extent of their other applications.” A recent definition by the National Research Council (NRC) in the US in 2004 of dual-use was again expressed explicitly with reference to technology in terms of civilian vs. military technology, echoing the previous definition. “In the language of arms control and disarmament, dual use refers to technologies intended for civilian application that can also be used for military purposes.” (National Research Council 2004, p. 18). Thus the early usages of the term were attached to technology and to artefacts, and referred to technologies that had already been developed or were coming on line.² Recent discussions also focus on technology (Pustovit and Williams forthcoming). Other recent discussions, such as those of Miller and Selgelid, and Resnik, talk explicitly about research. “The

² I use “artefact” here and elsewhere in a very general sense to refer to whatever is the substantive outcome of an application of R&D and technology, and do so mainly to have some term to denote such an outcome and to signify the distinction between knowledge on the one hand and things on the other. “Artefact” has the normal connotation of being a man-made thing. Where a ‘natural’ object, like an anthracis spore or variola major, is the focus of attention, the term may not seem appropriate. However, I take it that such natural objects will always be prepared or presented or manipulated in some way for some specific purpose, if they are to be of interest in the present discussion. So I understand “artefact” to also carry this connotation.

so-called ‘dual use dilemma’ arises in the context of research in the biological and other sciences as a consequence of the fact that one and the same piece of scientific research sometimes has the potential to be used for harm as well as for good” (Miller and Selgelid 2007, p. 524). The National Science Advisory Board for Biosecurity (NSABB 2007) concurs, giving its criterion as applying to “dual use research of concern” (NSABB 2007, p. 17). Finally, the NRC, in addition to referring to technologies, has also mentioned a class of worrisome experiments in Recommendation 2 of their report (National Research Council 2004, p. 5).

The first point to notice is that conducting experiments is one part of doing research, so if an experiment is of concern since its results could lead to two uses, one good or indifferent and one bad, then the activity could be described either as dual use experimentation or dual use research. Far from bringing two quite different activities under the rubric of dual use, we have here simply two different names for the same thing. There can, of course, be research that does not (directly) involve experimentation, and so the term “research” is wider than “experiment”, and this suggests that we should henceforth just talk about dual use research and understand that this includes experiment. The second point to notice is that technology is not research, but it is usually—and in this day and age can be considered to be exclusively—the *outcome*, and possibly also the tools, of research.³ Research is the first step in research and development (R&D), where the processes of discovery, invention, feasibility, design, etc., take place, followed by the prototype building, testing, etc., which take place at the development stage. Without development, there is a gap between research and technology. This does not mean that stopping a project at the conclusion of the research stage will mean that a new technology will never come on line, for someone else could complete the development stage. However, I think it is useful here to include development under the heading of research, so we have a distinction between all the elements that go into creating the knowledge of how to do something from that knowledge itself. Put another way, we have a distinction between the plans, designs, blueprints, engineering drawings etc., that give us directions how to make something or how to set up a process—the technology—from all that goes into making and creating those designs. Thus dual use research and dual use technology are related but clearly different, and it is to be expected that different sorts of problems will arise in regard to their control.

We are able to make some further distinctions on the basis of this relationship between dual use research and dual use technology. Thus, if a given research project R gives rise to a dual use technology T, then evidently R was dual use research (regardless of whether anyone was aware of this). Moreover, R may be dual use even if no technology has yet issued from it. The distinction may also help us differentiate technologies and classifications of dual use research. Consider the example of aerosolisation given by the BMA in its second report on bioweapons (BMA 2004, p. 45). They point out that the technique used to make aerosol of particles of the order of the few microns of a bacteria used to control gypsy moths,

³ For a general discussion of R&D and of the role therein of scientific research, see Chapter 1 of Forge 2008. J-J Saloman refers to the research system to describe R&D suggesting that there is really no sharp division between research and development, which I think is correct.

the primary purpose, can also be used to provide an aerosol of anthrax, the reason being that the bacteria are very similar. We have here one and the *same* technology processing different organisms: the technology is the same, the inputs and outputs are different—one good, we assume, and the other bad. If we call this technology T_m, then T_n, one that is capable of aerosolisation of particles of the order of nanometers will presumably be *different*. Suppose that T_n was a refinement of T_m based on essentially the same research R_a. The R_a may be dual use both in the sense that it enabled the dual use technology T_m, and T_n. Now, I will assume that we can summarise what is of concern about dual use by saying that it has the potential for *weapons development*, and hence has the potential to provide the means to harm, such as an aerosol of anthrax spores. Providing the means to harm is always a matter of concern.

Dual Use Artefacts

The OTA report refers to products, what I have called here artefacts, as well as technologies as dual use, and that is nothing new—we always knew that scissors could be used to stab people and that things designed for one purpose could be used for another. Some artefacts can be used as components or raw materials for making things quite unrelated to their primary purposes. For instance, ammonium nitrate is a common fertilizer but it can also be used to make improvised bombs. Nails, ball bearings, timers, batteries and mobile phones are mundane objects, but they can also be used to improvise weapons. Do we therefore need to include artefacts, substantive objects, as well as knowledge in the category of dual use? This would add a third subclass of items related to the other two, as artefacts are the material outcomes of the application of technology (or, in the wider sense of the term used here, the physical object of investigation). Some countries, like Australia and Saudi Arabia, already regulate the supply of ammonium nitrate precisely because of concerns about bomb-making. So this substance at least is, in effect, already classified as dual use. It is open for us to challenge this classification and suggest that the dual use category comprises only knowledge. That seems arbitrary, and, assuming the regulations are effective, unnecessary.⁴ But including artefacts in the category certainly complicates the issue, for we now have to try to distinguish those that should and those that should not be included.

Some components of improvised weapons should not be considered as dual use. For instance, the nuclear waste element of a dirty bomb is something that is highly dangerous and unwanted, and is something that needs to be carefully stored. It has no ‘good’ use. Much the same can be said of pathogens, like anthrax and smallpox, and poisonous gases, like sarin and tabun. Something useful might be learnt from working on these, but any samples also clearly need to be carefully

⁴ I used to think that dual use could be restricted to knowledge, with artefacts ‘represented’ in the category by the corresponding know-how, for instance the technical knowledge required to make them. Now I think they have to be included in the category.

guarded and controlled. I suggest, then, that while the existence of these materials raises significant issues as regards weaponisation, these are not primarily dual use issues. In this way we can exclude some of the components of improvised weapons from the dual use category. It is, however, difficult to say what should be included. Clearly, the supply of objects that have a wide range of uses and which are readily available cannot be controlled, and therefore it is pointless to classify them as dual use. In the end it seems that all we can do is this: known or possible components of improvised weapons whose supply can be regulated are candidates for inclusion in the category of dual use. This is, however, by no means entirely satisfactory. For instance, there is considerable imprecision introduced by the phrase “can be regulated”. What is the force of “can” here? How hard should we try to regulate the supply of something before we can be said not to be able to regulate it?

Dual use knowledge and dual use artefacts differ with respect to the form which their ‘bad’ uses take. We have assumed that dual use artefacts pose problems because they can be used for improved weapons; that is, weapons assembled from parts whose primary purposes are something different, something ‘not bad’. And we assume that the components of real weapons systems are not dual use, and hence do not figure in our attempt at picking out dual use artefacts. Again, they require control and regulation to prevent unauthorised acquisition, but this is not a dual use issue. Dual use knowledge, on the other hand, can be used to design weapons, to make *purpose-built* weapons not improvised ones.⁵ The example of an aerosol of micron-sized anthrax spores is of a purpose-built weapon, not something fortuitously cobbled together from things available off the shelf. The technology here is dual use because its (primary or intended) application is in pest control. The know-how that goes into making improvised weapons, by contrast, is not dual use, as knowing how to improvise a weapons does not have any ‘good’ application. Should we also say that the knowledge of how to make the *components* of improvised weapons, for instance, fertilizer, is dual use? The knowledge of how to make ammonium nitrate is at the level of first year chemistry, while details of the industrial process are more complex, though it seems that the latter is so widely available as to be pointless to try to restrict it. But this comparison between dual use artefacts and dual use knowledge suggests several things. First of all, regulation and control will need to take account of different groups with different expertise.⁶ For example, it is unlikely that those with the skills to weaponise anthrax spores would be seeking large amounts of fertilizer. In the second place, the relations between artefacts and knowledge does not necessarily mean that if an artefact is dual use, then so is the knowledge of how to make it. Thirdly, failure to control the supply of an artefact on a given occasion is not failure for all time, but it seems that once the knowledge of how to make weapon is known, then it is known for all time. More will be said about these matters in the next section.

⁵ I assume that we can distinguish purpose-built from improvised weapons.

⁶ I understand groups here to refer to any collectivity, from a terrorist cell to a whole state.

Threats, Risks and Values

To classify something as dual use should not simply be to flag that the item *could* have some bad use, that some bad use is in theory possible. If this were done, then the category of dual use would be unmanageably large and the ultimate objectives of control and regulation unattainable. The question is how to define dual use so as to restrict its membership. This must surely be done by taking into account historical or *contextual* factors, things that are functions of time and place. So the suggestion is that what counts as a dual use item need not be fixed for once and for all. This will be true if the relevant contextual factor is *threat*: if there is a group who has the intention to implement or enact the bad use, there is a threat. We can distinguish that nature of the threat, what the bad use is, from the level of threat, how likely it is that it can be carried out. And threats come and go.⁷ There is now a lower level of threat in Northern Ireland for car bombings than there was ten years ago, and I assume there is no such threat in Iceland. Resnik asks what a threat is, in relation to the NSABB criterion: what kind of threat is such as to trigger classification as dual use? There is no simple answer. All I can say is just this: for artefacts at least, there has to be some threat to make and use an improvised weapon for it to be dual use. It follows that the classifications of items as dual use because they can be used in improvised weapons can change with time and place.

Now consider the other end of the spectrum of dual use items, research findings that could lead to the development of new sorts of weapons, bioweapons that rely on new synthetic genomics, for instance, or that use standard recombinant techniques to make more virulent pathogens. The sorts of groups able to carry out such programmes will be more limited than those who can make improvised weapons. In the past, groups able to make use of dual use basic research have been advanced national weapons establishments, as was the case for all early work on the three kinds of weapons of mass destruction. At present, making nuclear weapons is beyond the capacity of any group smaller than a nation state. Does this mean we should not classify the relevant parts of nuclear physics and technology as dual use? It surely does not, because we want to restrict access to the technology to any state that might engage in nuclear proliferation, account for plutonium, etc. However, when we talk about nuclear weapons in relation to Iran, for instance, do we talk about it in terms of threat? It is unusual for anyone to threaten to use nuclear weapons, and even less usual for them to intend to do so, though we could speak of the threat to acquire nuclear weapons. I think it is better here to use the language of *risk*, and say that research findings are dual use when there is a risk that they will be used to design weapons systems. These weapons need not be new in the sense of never having been made before, but they will be newly designed and acquired by the groups in question.

The suggestion is that research findings which are such that there is a risk that they will be used to design weapons, that is that there is some likelihood that this will happen, are dual use. Once available, these weapons might pose a threat, but

⁷ As they do when one walks through the security screen at an airport: at that point, until one walks out of the baggage claim, scissors are dual use.

such a treat will not be relevant to any initial assessment of dual use. But this raises another issue. Thus far the assumption has been made that the intended or primary purpose of the dual use item is good or at least legitimate, while the secondary purpose by others is bad (see Miller and Selgelid 2007, p. 526). These judgements presuppose some framework of *values* that in turn influence the categorisation of dual use. I will only make a few remarks about this here. First of all, I would deny that every intended or primary purpose is good, or merely indifferent or neutral—military technologies are examples of bad primary purposes.⁸ If the intended or primary purpose is bad, it is possible for the secondary purpose to be good, and we have a kind of reverse dual use, but I assume that is not what we want to capture here. So if something only has bad uses, a judgement that depends on one’s value system, the question of dual use does not arise.⁹ From the present perspective, *all* instances of weapons innovation are classed as bad uses—this is an unargued assumption—even those done in the name of national defence by friendly states.¹⁰ The most scientifically and technically advanced states are, one assumes, those whose role is to control and regulate dual use items, since they have first access to them. If the issue is preventing *these* states from using research findings to make sophisticated new weapons, then it would have to be a matter of internal politics, or voluntary moratoriums by the weapons scientists themselves.

I have identified risk, threat and value as three contextual factors that need to be taken into consideration when filling out the dual use category. All of these are difficult to estimate, and all can change over time. Not only this, but the judgements about dual use may sometimes seem to involve more than one of these parameters. For instance, suppose the design process has reached the stage where it can easily be adapted for weaponisation, say of anthrax spores. Relatively little if anything is left of the R&D process, simply the adaptation of the technique to a new input. Sub-state groups like terrorist organisations having increasing abilities to engage in such operations. Now there is both a risk that the technique might be turned to a bad end, namely weapons production, and a threat that the output will be used, namely to cause harm. The risk and threat will, however, depend on different considerations: the former with how likely the group will obtain the technology and requisite tools and the threat on whether they will use it. Remove the risk, and there can be no threat. The message here is that the ‘higher up’ the knowledge spectrum control and regulation is made effective, the better off we will be.

With all this in mind, we can attempt a definition of dual use, as follows: An item (knowledge, technology, artefact) is dual use if there is a (sufficiently high) risk that it can be used to design or produce a weapon, or if there is a (sufficiently great) threat that it can be used in an improvised weapon, where in neither case is weapons development the intended or primary purpose. The judgements about risk and threat

⁸ See, for instance....

⁹ A related point is that a value system that weights harming much higher than the prevention of harm or doing good, will tend to count more technologies as bad, military technologies are again examples, and hence, for the reason just given, limit the dual use category. A consequentialist-type value system, on the other hand, will balance harms against compensating goods and tend to expand the category. The value system that informs a dual use categorisation therefore needs to be made explicit.

¹⁰ I have argued for this elsewhere, see Forge 2007, 2008.

are contextual in the sense explained. Also, the definition presupposes a system of values that informs the general attitude to weapons production as bad because it provides the means to harm.

Conclusion

This note is intended to be a contribution to the task of finding a workable definition of dual use, not the final word. What I claim to have done is show that we need to distinguish three sorts of dual use elements: research, technologies and also artefacts. These are related, in that research aims to give us technology, which in turn produces artefacts which are the main object of interest for enacting bad uses. There are, however, difficulties in marking off the boundaries of dual use in these categories, especially if this done by neglecting context. By “context” here I understand all that informs the capabilities and will of those states and sub-state groups who seek to develop ways to make bad uses, namely produce weapons, and this, ideally, gives us accurate estimates of threats and risks. Finally, dual use classification will depend on the value system adopted. How for all this goes to meeting Resnik’s challenge remains to be seen.

Acknowledgements I am grateful to Jonathan Herington and Kay Cambourn for their comments on an earlier version, and I am most grateful to this journal’s referees for their comments.

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