



Human Enhancement and Augmented Reality

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Abstract

Bioconservative bioethicists (e.g., Kass, 2002, *Human Dignity and Bioethics*, 297–331, 2008; Sandel, 2007; Fukuyama, 2003) offer various kinds of philosophical arguments against *cognitive enhancement*—i.e., the use of medicine and technology to make ourselves “better than well” as opposed to merely treating pathologies. Two notable such bioconservative arguments appeal to ideas about (1) the value of achievement, and (2) authenticity. It is shown here that even if these arguments from achievement and authenticity cut ice against specifically pharmacologically driven cognitive enhancement, they do not extend over to an increasingly viable form of technological cognitive enhancement—namely, cognitive enhancement via augmented reality. An important result is that AR-driven cognitive enhancement aimed at boosting performance in certain cognitive tasks might offer an interesting kind of “sweet spot” for proponents of cognitive enhancement, allowing us to pursue many of the goals of enhancement advocates without running into some of the most prominent objections from bioconservative philosophers.

Keywords Augmented reality · Technological human enhancement · Philosophy of technology · Intelligence augmentation · Cognitive enhancement

1 Introduction

Bioethicists interested in human enhancement focus on questions arising from using emerging—and merely possible—medicines and technologies to improve various aspects of our functioning. Some areas of this research are primarily concerned with influencing our emotional well-being and significant relationships,¹ while others are interested in the potential for biotechnology to make us morally better.² Our focus here

¹ For discussions of the ethics of emotional enhancement, see e.g., Kraemer (2011), Duncan (2016), Wasserman and Liao (2008). Meanwhile, see e.g., Earp et al. (2012) and Liao (2011) for explorations of how pharmacology might enhance our relationships (with partners and children respectively).

² For the classic argument in favour of the urgent pursuit of moral enhancement, see Persson and Savulescu (2008), and for a representative sample of criticisms of moral enhancement see e.g., Harris (2011), Melo-Martín (2018), Hardcastle (2018), Fenton (2010), Azevedo (2016).

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will be on *cognitive enhancement*—interventions that boost cognitive functioning in ways that don't merely treat pathology but rather make us in various ways cognitively "better than well".

There are a wide range of arguments for why we should refrain from pharmacological cognitive enhancement, even though such enhancements could potentially help us better gain true beliefs and knowledge.³ Two notable such arguments—the two on which we will focus on herein—appeal to ideas about the *value of achievement* and *authenticity*. The *cheapened achievements argument* holds that cognitive enhancement undermines the value of our (enhanced) cognitive achievements, and the authenticity objection holds that using enhancements is in some sense 'inauthentic'. Interestingly, both strands of bioconservative argument have thus far been used to argue against the use of actual (and possible) *pharmacological* cognitive enhancements, the most widely discussed examples of which involve off-label usage of drugs like Adderall and Modafinil, as well as potentially more effective cognition-boosting future versions of such drugs. As yet, such arguments have not been applied to cognitive enhancement via *augmented reality* (AR), and this is so despite the recent influx of AR use – not only widely throughout education⁴ – but also in sectors ranging from, e.g., tourism,⁵ archaeology,⁶ art,⁷ commerce,⁸ and medical treatment.⁹ Against this background, we'll consider whether either line of objection (*regardless* of whether it is compelling against pharmacological cognitive enhancement) has any teeth against AR as a form of cognitive enhancement.

Here is the plan. §2 outlines the cheapened achievements and authenticity objections as they have been traditionally developed as objections to pharmacological cognitive enhancement. §3 then reimagines versions of these objections as targeting, *mutatis mutandis*, AR specifically (on achievement-based and authenticity-based grounds) and suggests why these criticisms – despite prima facie plausibility – don't ultimately succeed as compelling objections to AR, and regardless of whether the more standard versions are effective against pharmacological cognitive enhancement. §4 closes by considering, in a wider context, what the foregoing suggests about the prospects of cognitive enhancement via AR (compared to other forms of cognitive enhancement).

³ For a recent overview and critical discussion of many of these arguments, see Gordon (2023). It is worth noting that these arguments typically take drugs to constitute enhancements (rather than mere therapeutic improvement) when they take one beyond normal levels of functioning, in order to make one 'better than well'. However, discussions are not unified on what the considerations are that determine this, and it is not a priori in these debates that drugs as such are always and everywhere enhancements. For discussion, see e.g., Bostrom and Sandberg (2009) and Gordon (2023, Ch. 1).

⁴ Billingham (2002), Garzón (2021), Garzón et al. (2019).

⁵ Loureiro et al. (2020).

⁶ Bruno et al. (2019)

⁷ Gong et al. (2022), Guazzaroni (2022).

⁸ Kowalczyk et al. (2021).

⁹ See Eckert et al. (2019). For a more general overview of uses of augmented reality across various sectors, see Chen et al. (2019).

2 Two Bioconservative Objections

2.1 The Cheapened Achievements Objection

To a first approximation, the core thought behind the cheapened achievements objection to enhancement proceeds as follows: *even if* ‘smart drugs’ (or more sophisticated kinds of cognitive enhancements that boost cognitive performance non-therapeutically) are cognitively *efficient* in that they help us attain our intellectual goals with comparative ease, their use at the same time *cheapens* the value of our resulting cognitive successes. Kass (2002) articulates the objection in terms of cognitive enhancements undermining the value of cognitive achievement by “divorcing performance from effort”, giving us an “easy life” filled with “trivial” achievements that could otherwise have been valuable. This might be the case, for instance, if one relied heavily on some kind of drug to solve a cognitive task (i.e., removing what might otherwise be standard obstacles by way of, e.g., attention, executive functioning, memory) in a way broadly analogous to how an athlete might rely on a performance enhancing drugs to attain an athletic objective.

The underlying idea here seems to be that the value of an achievement lies to a significant extent in the difficulty or effort exerted in attaining it, and enhancement reduces that difficulty or effort by eliminating what would otherwise be obstacles generated by cognitive limitations. This kind of philosophical thinking about achievements is defended by Bradford (2013, 2015) out with the human enhancement debate; she holds that it is specifically *overcoming difficulty* and the exertion of the will constitutive of overcoming difficulty that makes achieving a success more valuable than getting the same result in some other way (e.g., by luck or through someone’s help). We can think of Kass’s idea as potentially implicating something very much like Bradford’s way of thinking about the role effort plays in contributing to an achievement’s value.

In a similar vein, Sandel (2007) argues that cognitive enhancements undermine the value of cognitive achievements by disconnecting success from our *agency*, as opposed to through effort specifically. He claims in cases of drug-based performance enhancement, the credit is better understood as applicable not to the enhanced subject so much as “to the pharmacist” – i.e., enhancement aided successes are creditable less to ability than to the drug. The underlying idea here is that the value of a given achievement lies centrally in its being creditable to *our ability* rather than to something else. Sandel’s core idea that an aim’s being attained through ability matters for the value of the corresponding achievement lines up with part of Feinberg’s (1970) thinking about credit and blame more generally. Feinberg holds that the degree to which one deserves credit for an outcome is proportionate to the degree the outcome is caused by one’s character or abilities (rather than something else). Sandel’s claim that enhancement undermines the value of an achievement by divorcing performance from ability potentially gains intuitive support from the kind of ‘proportionality’ insight Feinberg embraces about credit to ability.

In sum, the key thinking we find in Kass and Sandel about cognitive enhancement and achievement is that when an intellectual aim is attained through

enhancement, then the extent to which it is attained through ability and effort is thereby (and roughly to that extent)¹⁰ diminished. Exercises of ability and effort, they suggest, are important in explaining why achievements are valuable. And so, when an aim is attained through enhancement, it is (roughly, to that extent) a less valuable achievement than it would be otherwise.

2.2 The Authenticity Objection

A second philosophically oriented argument that some bioethicists have appealed to in order to object to the use of cognitive enhancements has to do with the concept of *authenticity* (e.g., Bolt, 2007; Juth, 2011). To a first approximation, being authentic involves being ‘true to oneself’, where being true to oneself is widely taken to be an important contributor to a fulfilled human life (e.g., Taylor, 1992; Vannini & Williams, 2009).

The crux of the worry about enhancement in connection with authenticity is as follows: if we change e.g., our dispositions and our faculties with cognitive enhancements (including, e.g., smart drugs or by other non-therapeutic biomedical means that go beyond restoring our previous levels of functioning), we risk making ourselves thereby less authentic, less ‘true to ourselves’. There are a few background assumptions in play here in order for this general line of reasoning to hold; for instance, (i) that the relevant enhancements are (and contrary to what some transhumanists might hold) distinct from ourselves and a fortiori from our true selves, and (ii) further, that *being* true to ourselves would presumably involve refraining to take means to change ourselves in significant ways, including by altering our capacities.

It is worth noting up front that there is room to simply reject the very idea of a ‘true self’ as a useful notion.¹¹ Perhaps, as the thought goes, the very idea of a ‘true self’ is wrongheaded because either selfhood and agency are diachronic and dynamic (e.g., consider how we change our properties over time) in a way that makes the concept of a stable true self illusory¹²; or, perhaps, because our ‘true’ self is so widely applicable that it is not interesting – viz., perhaps the self (and its various ways of interacting with and being influenced by our environment) is so multifaceted that it will include rather than exclude the conditions under which we rely on, e.g., nootropic drugs to achieve cognitive aims.

However, for the sake of engaging charitably with the bioconservative’s argument – and, later, to see how pharmacological enhancement can be usefully contrasted with AR – let’s grant the bioconservative the underlying premise that the

¹⁰ The qualified language here is meant to be in keeping with the point (applicable to both the authenticity and cheapened achievement objections) that the value of authenticity and achievement, vis-à-vis a given success, is pro tanto value, which could in principle be defeated by overriding considerations (e.g., the saving of many lives) that would make it all things considered appropriate to pursue a cheapened achievement or an inauthentic enhancement. See Gordon (2023, Ch. 1) for discussion.

¹¹ For some experimental work on folk attributions of the ‘true self’, see, e.g., Newman et al. (2014) and Strohminger et al. (2017).

¹² See, e.g., Mogensen (2021) for recent criticism of the distinction between true and peripheral features of the self.

notion of a true self *is* useful (neither incoherent nor trivial). On this presumption, there are at least two (non-exhaustive) substantive approaches to unpacking this concept in the literature, provided by *essentialist* and *existentialist* thinking about the true self. *Essentialists* (Erler & Hope, 2014; Gelman, 2003) see the true self as made up of core characteristics that are deeply inherent within the person. Accordingly, to discover the true self on the essentialist view is to learn more about what those core aspects are. For those who endorse essentialism, the worry *vis-à-vis* cognitive enhancement takes the following general form: the more we change ourselves via alterations to our innate features, the less authentic we become. In the cognitive case specifically, using, e.g., nootropics directly alters our core cognitive faculties in doing so risks undermining authenticity, roughly to the extent that such nootropics are effective in changing our innate faculties (e.g., Maslen et al., 2014). By contrast, *existentialists* about authenticity (e.g., Golomb, 2012) see the issue differently; their thought is that – at least provided we act in accordance with our reflectively endorsed values – we can preserve our authenticity even if relying (and even to a significant extent) on drugs or other external means of improving our performance. Using a nootropic drug, for the existentialist about authenticity, isn't inherently inauthentic; what is more, the existentialist could make sense of how using nootropics to boost performance might even *promote* authenticity if it helped us to achieve a goal in line with a value we might have.

Here is not the place to adjudicate which position (or whether perhaps some position in between) best captures what it is in virtue of which one qualifies as being true to oneself. For present purposes, the goal is simply to use the essentialist and existentialist views as two opposing ways of assessing the impact enhancements might have on authenticity, with the aim of exploring how pharmacological and specific AR-based enhancements might lead to different results.

3 From Pharmacological Bioenhancement to Augmented Reality

Whereas virtual reality (VR) generates for the user a computer-simulated virtual 3D environment (e.g., through lenses and a helmet), augmented reality functions instead to 'augment' perception by superimposing digital objects on a visual field, resulting for the user in kind of 'perceptual hybrid'. AR can be accessed via handheld devices (e.g., smartphone) but also through glasses and smart lenses.¹³

While AR has been popular as a way of transforming gaming (e.g., Pokemon Go) and social media (e.g., Snapchat) on handheld phones, AR (apart from entertainment purposes) also offers the capacity to *enhance* cognition through intelligence augmentation.¹⁴ A simple example of intelligence augmentation via AR can be illustrated via its use in AR-assisted architecture¹⁵; one might, for instance, visualise what a room would look like with a wall taken out, or with a new kitchen design

¹³ (Turner, 2022).

¹⁴ For discussion, see Turner (2022).

¹⁵ See Hajirasouli and Banihashemi (2022) for an overview.

built in a certain way in detail and accuracy. The epistemic advantage here takes the form of a kind of augmented ‘simulation’; rather than to simply imagine the realisation of physical possibilities in the mind (which might be vague in detail or difficult to communicate), these possibilities can be virtually realised through superimposition on the existing physical space, shared, and refined in collaboration with others. Beyond simulation enhancement, AR can also be used to support what we might call *direct intelligence augmentation* – viz., where information is overlaid (either semantically or via images or cues) in one’s visual field to strategically guide decision making and action. A simple example of direct intelligence augmentation would be AR-supported glasses designed to improve navigation.¹⁶ More sophisticated imagined versions of direct intelligence augmentation via AR might include voice-controlled access to the World Wide Web, with text, images and video that would otherwise require browsers or screens to access instead superimposed in one’s visual field (via glasses or contact lens).¹⁷

In order to focus our discussion in what follows, we’ll use as a reference point two specific case pairs (and associated thought experiments) featuring AR-based cognitive enhancement in surgery (and involving direct intelligence augmentation) and in interior design (involving simulation enhancement). Each case pair involves a cognitive task done, respectively, done both without and with AR assistance. The guiding question that these case-pairs will challenge us to consider is whether AR-based cognitive enhancement is (or is not) open to envisioned versions of *either* the cheapened achievement or authenticity objections.¹⁸

First Case Pair

SURGEON-1 (No AR): A cardiothoracic surgeon is performing a heart valve operation while examining the surrounding tissue, diligently monitoring the patient’s vitals, and referencing their medical details. By synthesising all of this information through extensive effort and attention to detail, the surgeon realizes the patient needs further monitoring for potential risk of complication X.

SURGEON-2 (AR): A cardiothoracic surgeon who is operating on a heart valve realizes the patient needs further monitoring for potential risk of complication X. The surgeon makes this assessment while looking only at the heart itself, while all the other relevant information (vitals, medical history, etc.) is conveniently digitally overlaid in the visual field, allowing for an easy inference from this information to the conclusion that there is a risk of complication X that would benefit from further monitoring.

¹⁶ See (Lakehal et al., 2020; Montuwy et al., 2018).

¹⁷ For discussion of this kind of scenario, see Smart (2013) on the ‘web extended mind’.

¹⁸ These two scenarios were chosen as discussion cases for two reasons. First, each represents a particularly promising avenue in AR development, each representing a different industry sector that has invested significantly in AR. More importantly though, the cases feature different aspects of cognition that AR offers a route to enhance. Whereas the surgeon case reveals how AR can facilitate our capacity to draw knowledge-relevant inferences, the designer case shows instead how AR can facilitate creative cognition and imagination.

Consider, now, two contrasting cases of interior design. The relevant background here is that some home designers use AR to envisage what certain furniture will look like in one's home. For example, Ikea has bought a version of this AR technology to try to sell more furniture in store.¹⁹ Imagine, then, two home designers, each of whom is given 50 pieces of furniture and asked by a customer to propose how it would be arranged. This gives us our second pair of cases.

Second Case Pair

DESIGNER-A (No-AR): Given the above background, the designer relies purely on imagination, along with pictures of the rooms in the house, to envisage what would go where, and draws up a configuration.

DESIGNER-B (AR): Given the above background, the designer uses AR to virtually play around with the arrangements until coming to the same conclusion as designer A.

With these two case-pairs in mind, let's now think critically about (recast versions of) the cheapened achievements objection and the authenticity objection, taking these objections in turn in §3.1 and §3.2. In each section, what will be relevant is whether the AR-variation of each case either results in a cheaper achievement (compared to the No-AR variation, as in §3.1) or in one that is less authentic (compared to the no-AR variation).

3.1 The Cheapened Achievements Objection to AR

First, we'll focus on SURGEON-1 and SURGEON-2. Applied to this pair of cases (featuring No AR and AR, respectively), the proponent of the cheapened achievement argument will presumably reason as follows: the inference made in SURGEON-2, aided by AR, is (unlike the same inference made in SURGEON 1) *not* an intellectual success primarily explained by the user's intellectual ability, but rather, by the assistance from digital scaffolding, viz., to the AR information overlay that organised the information and facilitated the ease of the intellectual task for the user. This is at any rate the strategy of reasoning that most resembles the kind of criticism we find already in the case of pharmacological bioenhancement, where drugs rather than visually overlaid information are claimed to be what is explanatorily central in accounting for cognitive success.

There are, I think, two salient lines of response to this reasoning. Firstly, even if relevant intellectual task is easier (on account of the AR intelligence augmentation) in SURGEON-2, it remains the case that there is still a very significant level of intellectual ability nonetheless explaining the why the surgeon correctly ascertains (in

¹⁹ See e.g., <https://www.ikea.com/global/en/newsroom/innovation/ikea-launches-ikea-place-a-new-app-that-allows-people-to-virtually-place-furniture-in-their-home-170912/> for discussion of an early version of this technology.

SURGEON-2) that the patient needs further monitoring for potential risk of complication X – so much so that it remains plausible even in SURGEON-2 that intellectual ability *primarily* explains the success, despite the user’s reliance on AR, and even despite the AR making the cognitive task (of working out that the patient needs further monitoring for a risk of complication X) much easier than otherwise.

To see this, we might compare two sub-versions of SURGEON-2, one in which an expert cardiothoracic surgeon is using the AR, and another in which an amateur is using the AR. Plausibly, even with AR, the amateur is not in a position to draw the inference that there is a risk of complication X without background expertise, which includes expert medical training, perhaps also training in statistical methods, and prior experience with complication X. The AR here just makes the inference more straightforward to draw predicated upon having *relevant expertise*. But once this is appreciated, analogies like Sandel’s (i.e., the claim that “the credit goes to the pharmacist”, or to the AR designer) look to miss the mark. An underlying idea here is that a given success isn’t going to be *primarily* creditable to some item of scaffolding a user takes advantage of (technological, pharmacological, or otherwise) which, *absent* the presence of exercise of ability in a given case, would be insufficient for getting the relevant result – and this is so even if there is causal dependence of the success in that given case on the scaffolding. (Compare: an expert mathematician might not have proven a formula on a given occasion had she not had a protein-rich breakfast that boosted her energy sufficiently; her developed mathematical proof at noon then will be causally dependent upon the breakfast; yet, her mathematical success is not primarily explained by the breakfast because, after all, absent the extraordinary mathematical ability that is required to have been in a position to make the proof, the breakfast would have been effectively useless. If the above reasoning is on the right track, then, we can see how (given the analogy between the mathematician and the surgeon in SURGEON-2), it would be a mistake to think it’s *false* that the surgeon’s success is primarily explained by her ability (in the way befitting of valuable achievement) even when the AR-presentation of the information facilitates the success and features in the causal chain that leads to it.

Even if one is not persuaded by the above line of thinking, though, there is a further line of response available to the proponent of AR-based cognitive enhancement in response to the cheapened achievement objection. This second reply maintains that the objection overgeneralises when construed as an objection to AR-based cognitive enhancement *regardless* of whether it would overgeneralise in the case of pharmacological cognitive enhancement. Consider that, in SURGEON-2, what is facilitating the inference (to the conclusion that there is a risk of complication X) is the *presentation* of the information. However, we already know that the presentation of information can facilitate cognitive performance even *without* any use of AR and that this is an ubiquitous phenomenon.

For example, consider the Duncker Candle Test,²⁰ often used in order to show the dependence of cognitive flexibility on informational presentation. In this experiment, participants found it significantly easier to work out that a box with tacks

²⁰ See Duncker and Lees (1945).

could be used as a candle holder *if* the box as presented to them without the tacks in it rather than otherwise. But in such cases we don't think the value of the relevant achievement is denigrated in any interesting way²¹; we don't credit the intellectual success to something other than the ability even when something (e.g., informational presentation) facilitates the exercise of the ability. As the thought goes then, a proponent of the cheapened achievements objection in the AR case would need to either embrace a rather wide scoping scepticism about the conditions under which our intellectual successes are explained by our intellectual abilities, *or* alternatively give some explanation for why (implausibly, it seems) when the presentation of information facilitates a cognitive task, this fact bears negatively on whether the agent's succeeding in that task is an achievement creditable to her abilities when the source of that presentation of information is AR, but not when the source of that presentation of information is something else. Going this latter route risks an objectionable kind of arbitrariness.

So, what about the AR and imagination/simulation case pair (i.e., DESIGNER-B with AR, and DESIGNER-A without AR)—does it fare better than our SURGEON case pair as a reference point for an achievement-based challenge to the value of AR-enhanced cognitive performances?

We can easily imagine the proponent of such an argument maintaining that using exclusively brain-bound imagination to generate the result is more valuable than relying on AR for assistance.

But this line of thought quickly faces problems. First, notice that both DESIGNER-A *and* DESIGNER-B are cases in which the relevant agent uses brain-bound imagination. When using AR, the agent in DESIGNER-B uses imagination *prior* to testing out what the furniture looks like—they are imagining what to try out in AR and in what way. So, any argument that *no* imagination is used in the second (DESIGNER B) case seems wrong. A second problem is this: if we think of the cases in terms of comparative effort, it might initially look as though the agent in DESIGNER-B (in which the designer uses AR to arrange the furniture) is much *easier*. However, that might be too hasty an assessment. Consider that with AR possibilities (e.g. where there are potentially hundreds of pieces of furniture to try out anywhere in a home), one might feel a responsibility to try more options, and in turn, exert *more effort* to manipulate more of the possible option space, think through more possibilities concretely, and so on. In contrast, DESIGNER-A—the case in which the designer relies on imagination alone—is a case in which the designer might be inclined to simply go with the first option they imagine and which works. Thinking about this case pair in this way, we can easily see how the designer using AR might actually put more *thought* into the outcome than the designer relying on imagination alone.

²¹ Note that the kind of value at issue here is achievement-related value, that is, value in connection with whether the surgeon would be praiseworthy for their skill; a separate dimension of value might be the kind of value that consists in the effectiveness of the therapy for the patient. Our discussion here concerns the former kind of value.

So, where does all of this leave us with respect to the cheapened achievements objection to cognitive enhancement via AR? It seems that regardless of whether we think (as, e.g., bioconservatives like Kass and Sandel do) that pharmacologically enhanced cognitive achievements are less valuable when one relies on smart drugs, it's far from clear that the arguments used to suggest this are going to be very compelling in the case of cognitive enhancement via AR.

3.2 The Authenticity Objection to AR

So what about the authenticity objection recast specifically to AR? Does this have more promise than a (recast version of the) cheapened achievements objection?

For starters, it's not straightforward to get such an authenticity argument against AR off the ground at least if the notion of authenticity is unpacked on existentialist rather than essentialist lines. After all, recall, for the existentialist about authenticity, choices manifesting authenticity are choices in alignment with values that we would endorse on reflection. Accordingly, for the existentialist about the authentic self, AR use can in principle be entirely authentic if one would reflectively identify as embracing the kind of cognitive assistance AR provides. In a concrete case, then, so long as, e.g., a surgeon or designer were to embrace values that either permitted or required availing oneself to certain kinds of advantageous technological assistance in surgery and design, respectively, then their acting in alignment with this reflectively endorsed value by embracing AR in facilitating cognitive tasks would be authentic. (Indeed, on the presumption here that they have respectively reflectively endorsed such values, *forbearing* the use of such assistance when it is available would potentially qualify as inauthentic in virtue of being misaligned with their reflectively endorsed values).

The more philosophically challenging way to frame an authenticity-based argument against enhancement via AR would have us unpack authenticity along essentialist lines of a "true self". As discussed in Section 2.2, the essentialist about authenticity holds that the true self is composed of a set of core traits that we can discover through self-reflection over time. With this view of authenticity in mind, the imagined bioconservative line based on essentialism here might go as follows: one who relies on AR to accomplish certain intellectual tasks (e.g., as in the diagnostic assessment in SURGEON-2) is acting or thinking inauthentically, by thinking in ways that are different from how they would if they relied on their essential characteristics. The objection would tell us that a more authentic way to think through problems will be one in which one leaves one's visual field unembellished by visual overlays. In other words, one will be manifesting just one's 'core' or natural capacities to (for example) link pieces of information together.

Before considering some replies, it is worth clarifying what a proponent of this line of objection is not committed to. They are not committed to any kind of *ultima facie* claim about whether it is *all things considered* better to forego using AR for surgical/design purposes on purely authenticity-based grounds. The value of authenticity is rightly understood on the bioconservativist side as a kind of pro tanto consideration that could be overridden by competing values, including, e.g., prudential

values. Even so, the pro tanto claim is still a strong one – on the view under consideration here (an essentialist-underwritten authenticity based argument against AR-based cognitive enhancement) we have a standing (pro tanto) reason to refrain from using AR to facilitate our cognitive goals, namely, that reaching them through such means is incompatible with the value of attaining such goals in an authentic way.

Even on the above qualified way of formulating the argument (which clearly distinguishes it from an implausible *ultima facie* reading), the argument faces at least two serious objections. Firstly, even if we grant the (contentious) essentialist account of the authentic self, it is far from clear we should accept that thinking or reasoning aided by AR is, as such, *inauthentic*. Arguably, a disposition to use tools to achieve goals is an *aspect* of (rather than something that runs contrary to) individuals qua human beings.²² This is the line of thought embraced by transhumanists like Clark (2003) who embrace the view that using tools and the environment to achieve goals is constitutive of being the kind of thing we are – viz., ‘natural born cyborgs’. I want to emphasise that while this transhumanist position if correct implies that using AR isn’t necessarily inauthentic even on essentialist grounds, a weaker kind of position also gets this result. Suppose we remain neutral on whether transhumanists like Clark are right that it is ‘of our essence’ to use tools of which AR is an instance. We might nonetheless think that using tools to attain our goals is *not incompatible* or otherwise in tension with our essence, regardless of whether it is constitutive of it. This more moderate position holds that whatever our essential characteristics are, they are at least compatible with being supplemented with tools to achieve our aims. This more moderate position (which requires no commitment to transhumanism) is, importantly, enough to block the reasoning from an essentialist view about what makes us authentic to the conclusion that using AR to achieve our goals is inauthentic. Once this point is granted, however, it becomes unclear why the agent in SURGEON-2’s using AR overlay to assess a patient would be inauthentic any more than (say) a person using fire or light in order to read at night, or any other case in which we think that one’s reliance on one’s environment is (even if not constitutive of our being who we fundamentally are) at least *compatible* with our being so.

That said, consider now that even if we were to grant an essentialist construal of authenticity *and* grant further that at least some ways of using tools to aid thinking tasks can be inauthentic with reference to such a conception of authenticity, it would still be far from clear that AR use specifically should be count as among them.

To see how this second reply in defence of cognitive enhancement via AR is meant to work, consider an example distinction between two cases. In Case 1, suppose that someone is using a sophisticated, futuristic brain-computer interface (BCI) that ‘feeds’ them medical information via thought commands, effectively obviating the need for medical skill. Meanwhile, suppose Case 2 is simply SURGEON-2—in other words, a case of a cardiothoracic surgeon using AR. There is an important contrast here that can help us see why it’s not so plausible to suppose that AR use is a problematically inauthentic case of tool use. Specifically, Case 1 (i.e., the BCI case) is such that the relevant ‘thinking’ is really outsourced *entirely* to the relevant

²² See Gordon (2023) for a more detailed development of this point.

technology. In Case 2 (i.e., the AR case), on the other hand, the thinking relies critically on one's own abilities (e.g., internal capacities for inference) that the essentialist will recognise as authentic by her own lights. Thus, we might think then that even granting the essentialist's own way of understanding authenticity, AR use will not end up counting as inauthentic, even if *some* kinds of technological enhancements (e.g., use of radical BCIs) seemingly would by such standards.

4 Concluding Remarks

This paper has aimed to make two new strands of progress in existing debates about cognitive enhancement. The first has been to expand the scope of two prominent bioconservative lines of argument against cognitive enhancement, and which have been debated principally in the pharmacological case, and to show that these arguments (concerning the value of achievements and authenticity, respectively) have at least *prima facie* applicability when reimagined as arguments targeting the enhancement of cognition through augmented reality. The example cases used to guide discussion have featured AR-assisted cognition via direct intelligence augmentation (through superimposed information overlay) and AR-assisted imaginative simulation. The conclusion reached – and this is the second strand of progress made – is that we have good reason to think that neither an achievement-based nor an authenticity-based objection to AR-based cognitive enhancement ultimately holds water, and this is so regardless of what we make of these strands of objections in traditional bioethical debates about enhancement via ‘smart drugs’.

Placed in a wider context, these results have two ramifications for future work in debates about cognitive enhancement. First, *if* bioconservative bioethicists wish to extend their criticisms of cognitive enhancement to the case of AR-based cognitive enhancement specifically, then reasoning other than standard achievement and authenticity based rationales would have to be developed. Second, for proponents of cognitive enhancement, it is worth registering that the fact that AR-assisted cognitive enhancement holds up against these lines of bioconservative criticism as it does may be suggestive of AR-assisted enhancement as a particularly promising strategy. That is, AR-assisted enhancement may represent a variety of cognitive enhancement that can be most straightforwardly justified to those initially inclined to doubt the viability of enhancement more generally on philosophical grounds.²³

²³ Many thanks to reviewers at *Philosophy & Technology* for thoughtful comments that improved this paper, and to audiences at the Centre for the Study of Perceptual Experience's 'Epistemology and AR' workshop (May 2022), and the Bled Philosophical Conference (June 2023) for feedback on early versions of the arguments discussed in this paper.

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References

- Azevedo, M. A. (2016). The misfortunes of moral enhancement. *Journal of Medicine and Philosophy*, 41(5), 461–479.
- Billinghurst, M. (2002). Augmented reality in education. *New Horizons for Learning*, 12(5), 1–5.
- Bolt, L. L. E. (2007). True to oneself? Broad and narrow ideas on authenticity in the enhancement debate. *Theoretical Medicine and Bioethics*, 28(4), 285–300.
- Bradford, G. (2013). The value of achievements. *Pacific Philosophical Quarterly*, 94(2), 204–224.
- Bradford, G. (2015). *Achievement*. Oxford University Press.
- Bostrom, N., Sandberg, A. (2009). Cognitive enhancement: Methods, ethics, regulatory challenges. *Science and Engineering Ethics*, 15(3), 311–41.
- Bruno, F., Barbieri, L., Mangeruga, M., Cozza, M., Lagudi, A., Čejka, J., Liarokapis, F., & Skarlatos, D. (2019). Underwater augmented reality for improving the diving experience in submerged archaeological sites. *Ocean Engineering*, 190, 106487.
- Chen, Y., Wang, Q., Chen, H., Song, X., Tang, H., Tian, M. (2019). An overview of augmented reality technology. *Journal of Physics: Conference Series*, 1237, 022082. IOP Publishing.
- Clark, A. (2003). *Natural-born cyborgs: Minds, technologies, and the future of human intelligence*. Oxford University Press.
- de Melo-Martín, I. (2018). The trouble with moral enhancement. *Royal Institute of Philosophy Supplement*, 83, 19–33. <https://doi.org/10.1017/s1358246118000279>
- Duncan, S. (2016). The nature of the emotions and the ethics of cosmetic psychopharmacology. *Public Affairs Quarterly*, 30(1), 67–82.
- Duncker, K., & Lees, L. S. (1945). On problem-solving. *Psychological Monographs*, 58(5), i.
- Earp, B. D., Sandberg, A., & Savulescu, J. (2012). Natural selection, childrearing, and the ethics of marriage (and divorce): Building a case for the neuroenhancement of human relationships. *Philosophy & Technology*, 25(4), 561–587. <https://doi.org/10.1007/s13347-012-0081-8>
- Eckert, M., Volmerg, J. S., & Friedrich, C. M. (2019). Augmented reality in medicine: Systematic and bibliographic review. *JMIR MHealth and UHealth*, 7(4), e10967.
- Erler, A., & Hope, T. (2014). Mental disorder and the concept of authenticity. *Philosophy, Psychiatry, & Psychology*, 21(3), 219–232.

- Feinberg, J. (1970). *Doing & deserving; Essays in the theory of responsibility*. Princeton University Press.
- Fenton, E. (2010). The perils of failing to enhance: A response to persson and savulescu. *Journal of Medical Ethics*, 36(3), 148–151.
- Fukuyama, F. (2003). *Our posthuman future: Consequences of the biotechnology revolution*. Farrar, Straus and Giroux.
- Garzón, J. (2021). An overview of twenty-five years of augmented reality in education. *Multimodal Technologies and Interaction*, 5(7), 37.
- Garzón, J., Pavón, J., & Baldiris, S. (2019). Systematic review and meta-analysis of augmented reality in educational settings. *Virtual Reality*, 23(4), 447–459.
- Gelman, S. A. (2003). *The essential child: Origins of essentialism in everyday thought*. Oxford Cognitive Development.
- Golomb, J. (2012). *In search of authenticity: Existentialism from kierkegaard to camus*. Routledge.
- Gong, Z., Wang, R., & Xia, G. (2022). Augmented Reality (AR) as a tool for engaging museum experience: A case study on chinese art pieces. *Digital*, 2(1), 33–45.
- Gordon, E. C. (2023). *Human enhancement and well-being: A case for optimism*. Taylor & Francis.
- Guazzaroni, G. (2022). Virtual and Augmented Reality in Art During the Pandemic. In *Extended reality usage during COVID 19 pandemic*, 89–93. Springer.
- Hajirasouli, A., & Banihashemi, S. (2022). Augmented reality in architecture and construction education: State of the field and opportunities. *International Journal of Educational Technology in Higher Education*, 19(1), 39.
- Hardcastle, V. G. (2018). Lone wolf terrorists and the impotence of moral enhancement. *Royal Institute of Philosophy Supplements*, 83, 271–291.
- Harris, J. (2011). Moral enhancement and freedom. *Bioethics*, 25(2), 102–111.
- Juth, N. (2011). Enhancement, autonomy, and authenticity. *Enhancing Human Capacities*, 34–48.
- Kass, L. (2002). *Life, liberty and the defense of dignity: The challenge for bioethics*. Encounter Books.
- Kass, L. R. (2008). Defending human dignity. *Human Dignity and Bioethics*, 297–331.
- Kowalczyk, P., Siepman, C., & Adler, J. (2021). Cognitive, affective, and behavioral consumer responses to augmented reality in e-commerce: A comparative study. *Journal of Business Research*, 124, 357–373.
- Kraemer, F. (2011). Authenticity anyone? The enhancement of emotions via neuro-psychopharmacology. *Neuroethics*, 4(1), 51–64.
- Lakehal, A., Lepreux, S., Efstratiou, C., Kolski, C., Nicolaou, P. (2020). Investigating smartphones and AR glasses for pedestrian navigation and their effects in spatial knowledge acquisition. In *22nd international conference on human-computer interaction with mobile devices and services*, 1–7.
- Liao, S. M. (2011). Parental love drugs: Some ethical considerations. *Bioethics*, 25(9), 489–494. <https://doi.org/10.1111/j.1467-8519.2009.01796.x>
- Loureiro, S. M., Correia, J. G., & Ali, F. (2020). 20 years of research on virtual reality and augmented reality in tourism context: A text-mining approach. *Tourism Management*, 77(April), 104028. <https://doi.org/10.1016/j.tourman.2019.104028>
- Maslen, H., Faulmüller, N., & Savulescu, J. (2014). Pharmacological cognitive enhancement—How neuroscientific research could advance ethical debate. *Frontiers in Systems Neuroscience*, 8, 107.
- Mogensen, A. L. (2021). Is identity illusory? *European Journal of Philosophy*, 29(1), 55–73. <https://doi.org/10.1111/ejop.12552>
- Montuwy, A., Cahour, B., Dommès, A. (2018). Older pedestrians navigating with AR glasses and bone conduction headset. In *Extended abstracts of the 2018 CHI conference on human factors in computing systems*, 1–6.
- Newman, G. E., Bloom, P., & Knobe, J. (2014). Value judgments and the true self. *Personality and Social Psychology Bulletin*, 40(2), 203–216.
- Sandel, M. J. (2007). *The case against perfection: Ethics in the age of genetic engineering*. Harvard University Press.
- Smart, P. R. (2013). The web-extended mind. In *Philosophical engineering*, 116–33. John Wiley & Sons, Ltd. <https://doi.org/10.1002/9781118700143.ch8>
- Strohming, N., Knobe, J., & Newman, G. (2017). The true self: A psychological concept distinct from the self. *Perspectives on Psychological Science*, 12(4), 551–560.
- Taylor, C. (1992). *The ethics of authenticity*. Harvard University Press.
- Turner, C. (2022). Augmented reality, augmented epistemology, and the real-world web. *Philosophy & Technology*, 35(1), 19. <https://doi.org/10.1007/s13347-022-00496-5>
- Vannini, P., Williams, J. P. (2009). Authenticity in self, culture and society. *Authenticity in Culture, Self, and Society*, 1–20.

Wasserman, D., & Liao, S. M. (2008). Issues in the pharmacological induction of emotions. *Journal of Applied Philosophy*, 25(3), 178–192.

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