A Viewpoint on the Societal Impact of Everyday Augmented Reality and the Need for Perceptual Human Rights

Joseph O'Hagan | University of Glasgow
Jan Gugenheimer | TU Darmstadt
Florian Mathis | University of St. Gallen
Jolie Bonner | University of Glasgow
Richard Jones | University of Edinburgh
Mark McGill | University of Glasgow

Everyday augmented reality will become as fundamental to our daily lives as smartphones are today. — empowering users, communities, businesses, governments, and more to alter or mediate our perception of reality. But is society prepared for a world where a common objective reality that we all perceive and experience no longer exists?

The personal computing landscape is on the verge of a transition: from the 2D surfaces of smartphones, monitors, and other "physical" displays, to the ethereal spatial computing of augmented, mixed, and extended reality (AR/MR/XR).[1] Currently, AR headsets, glasses, and more (hereafter referred to collectively as AR headsets) come equipped with a variety of sensing that drives their capability to understand the world around them, for example, packing eye tracking, outward-facing red, green, blue plus depth sensing, directional microphone arrays, etc.[2] into wearable form factors. Coupled with their ability to render virtual visual and auditory augmentations around a user, these headsets present the foundations for a transformative consumer technology—supporting personal augmentation of intelligence, perception, cognition, and more.

In time, such devices will inevitably arrive at consumer-friendly, socially acceptable form factors, designed to be comfortably worn and used all day—what has varyingly been referred to as *everyday, pervasive, ubiquitous AR*. The sheer potential utility of everyday AR may inevitably force adoption, with users being no more able to opt out from wearing AR headsets in the future than they can feasibly opt out of owning smartphones today. Everyday AR headsets will place themselves between our eyes/ears and our surrounding reality, *mediating our perception of reality* throughout our daily lives.[1] In the process, everyday AR will empower users, communities, business, governments, and other entities to alter, augment, diminish, or otherwise mediate our perception of people, places, objects, media, and more.

This capacity for revolution has been recognized by technology companies, who are spending billions developing their own AR hardware, software, and platforms, vying to control this future. Facebook/Meta invested US$10 billion in 2022 alone into XR development, including AR headset R&D; Microsoft received US$22 billion from the U.S. Army for AR headsets, software, and services in 2022; Google/Alphabet has made multiple billion-dollar AR acquisitions; and Apple's CEO Tim Cook has been repeatedly quoted as anticipating AR to become one of their most significant contributions to the world, having a potentially profound impact on our digital lives. Given the seemingly inevitable march toward wearable everyday AR, it becomes a pressing concern to consider the *societal* impact of this technology—meaning both the positive and negative effects everyday AR could have on influencing the behavior and attitudes of individuals, groups, communities, and more.

With this viewpoint, we first reflect on how everyday AR could immediately reshape our perception of society through augmentation of people, spaces, and media. We then highlight some of the societal challenges and harms raised by this capability for perceptual mediation, focusing on examples that transpose existing digitally enacted harms (for example, in social media and the web) into our perception of reality, from abuse, to manipulation, to information disorder. Reflecting on these harms, we pose the question: Does the advent of everyday AR necessitate new *perceptual* human rights governing who can impose their digital will upon our perception of reality and how and to what degree they can do this?

The Case for Everyday AR: Reshaping Our Perception of Society

Augmented Social Expression of Identity

If we are to understand the potential societal impact of everyday AR in the future, one starting point is to examine how smartphone AR is currently used. Consider our outward presentation/expression of *social identity*. In a world where an AR-driven metaverse is a reality, this technology offers the possibility to control how we, as individuals, wish to be perceived by others and also provides complete control over how we perceive

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ourselves and others in turn.[3] Where currently face filters are applied through the lens of the smartphone, in time we could curate our own public-facing digitally augmented facade as is currently evidenced through applications such as Instagram and Snapchat, but transposed to reality. This could have notable implications for sustainable fashion (what could be faster fashion than the instantaneous change of an augmentation?) and also could unlock a powerful capacity to help individuals better present their "authentic self" (in terms of outward presentation of gender identity, hidden disabilities, and more) through shared, social augmentations perceived by all those wearing AR glasses. More generally, augmented identity could benefit a breadth of other social interactions by allowing people to selectively convey information about themselves to others and adapt their appearance to the context, breaking down interpersonal barriers.

Augmentation of Public Spaces

With precise localization driven by visual positioning systems, AR could also be used to augment our perception of shared, social real-world spaces. In doing so, everyday AR will offer individuals, local communities, and businesses the possibility of decentralized virtual digital urban regeneration. Consider virtual "pop-up" hubs in open spaces to encourage intra/intercommunity engagement; "digital placemaking," where a community can identify and promote specific values and the preservation of local cultural heritage through cultural metaversal layers; or other alterations of the aesthetics and feel of a space to enhance well-being and encourage visitation, exploration, and a greater sense of local ownership and agency.

Augmentation of Media

Personalized augmentations could also be applied to *any facet of our perceivable reality*. For example, our perception of both physical print and video news media could be supplemented to support real-time fact checking, provide background information and alternate sources or counter viewpoints, and otherwise aid and enhance comprehension. Everyday AR would become a large-language-model-driven personalized expert on our shoulder, seemingly augmenting our intelligence and cognition.[1,2]

The Case Against: Perceptual Vulnerabilities and Harms

However, for every imagined digital utopia, there is the reality of an (often unanticipated) dystopia. Everyday AR is unlikely to be the exception here— the mechanisms by which social good can be enacted also pose new vulnerabilities and harms. While the potential for undermining privacy[2] and security[4] is well understood, it is the emerging *perceptual* harms that are our focus.

Identity-Based Harms

For individuals, the capacity to augment how we, and others, are perceived could risk provoking a range of psychologically damaging reactions as users feel a pressure to conform their appearance to perpetuated ideals, as already noted in AR-driven "selfie" culture.[3] And, for malicious actors, this capability could enable new forms of abuse.[5] It is easy to envision a convergence of AR sensing and cheap/deep fake technology to, for example, sexualize or otherwise appropriate the identity of others for socially unacceptable and abusive reasons[3] (for example, racism and blackface filters). Lemley and Volokh considered the legality of this ability to augment our personal sensescape and the sensescapes of others, asking: "What if people use this… to make [you] appear ridiculous… without your knowledge or consent? Or what if they want to make you appear naked?"[6]

Persuasion, Coercion, and Manipulation

AR technology also offers an unprecedented tool for persuasion and manipulation by becoming the de facto gatekeepers of our perception of people, places, events, and information—which could be altered based on user preferences/attitudes (such as reinforcing political leanings and bias), the desires of AR platform gatekeepers, such as technology companies (for example, for advertising), governmental mandates (for example, for propaganda), and more. In being able to track and understand our preexisting likes and attitudes[7] and actions,[2] AR headsets also offer the possibility for enhanced behavioral nudging and manipulation of movements or memory.[8]

If we consider the common use of advertising to subsidize the cost of hardware and extend this approach into everyday AR hardware/platform subsidies, there are immediate anticonsumer risks. For example, a corporation might target virtual advertising based on contextual and psychographic data,[2] force users to fixate on/interact with immersive advertising,[1] incorporate peripheral background advertising for continual exposure,[9] or engage in predatory pricing to detect and undercut prices in store, suggesting purchases be made through the platform instead. Advertising is just one

pertinent example of the potential consequences of allowing third parties to augment and dictate our personal sensorium, introducing the ability to manipulate individuals' behavior across society.

Reality Censorship and Information Disorder

Building on the preceding advertising example, an everyday AR headset would bestow anyone the capability to remove or obfuscate a real-world advertisement (diminished reality censorship) or amend it (altered reality disinformation/malinformation). This could, in theory, be achieved (non)consensually and (eventually) imperceptibly to an AR user and be used as a mechanism for attitudinal change or instigating bias.[1] For a benign example, consider how Pepsi might augment Coca-Cola advertisements and vice versa. For a less benign example, consider how major political parties and nonparty campaigners might exploit such a capacity for political gain. Where currently digital disinformation is at least limited to the sphere of web-based social media, AR would enable this to be writ large and embedded in our everyday experience. A real-world political advert by one party could be rebutted, undermined, or obfuscated by another. Social groups could be visually "othered" based on personal characteristics to confirm and amplify bias. Also, elements of reality could be visually and/or aurally "blocked" or otherwise replaced, for example, by removing or altering visible signs of poverty in a public space.[10] An ability to augment existing print and video media could be used to reinforce perceived filter bubbles and bias, censor information, and undermine the credibility of the media itself.

In effect, everyday AR will open the door to new perceptual attacks and targeted augmentation of *any perceivable visual or auditory element of reality*. Generative artificial intelligence (AI) content creation tools, coupled with AR tracking application programming interfaces, could empower anyone to author and apply novel visual augmentations/alterations to reality. This capacity has already been raised in discussions around *AR activism*[11]; for example, as part of Occupy Wall Street, *ProtestAR* virtually augmented buildings and presented virtual avatar occupations.

Existing and Envisaged Digital Human Rights

In terms of existing rights, the European Convention on Human Rights contains relevant provisions regarding human rights to *conscience* (freedom of thought, conscience, and religion, Article 9), *expression* ("freedom to hold opinions and to receive and impart information and ideas without interference by public authority and

regardless of frontiers," Article 10), and *property* (Protocol 1:1). Building on this is a complex web of national and international legislation addressing digital safety. For example, the European Union (EU) Digital Services Act in part addresses malicious content and deceptive designs, and the EU AI Act addresses manipulation by AI, while the International Covenant on Civil and Political Rights (of which 173 nations, including the United States, are parties) also contains *an article relating to freedom of expression*. But it remains unclear how such protections would apply to the *everyday AR* world.[12] The European Commission, recognizing that existing human rights do not sufficiently address *digital society* concerns, recently proposed a Declaration on Digital Rights and Principles (https://digital-strategy.ec.europa.eu/en/library/declaration-european-digital-rights-and-principles), noting that "democratic oversight of the digital society… should be further strengthened" by "making sure that technological solutions respect people's rights." This includes "safeguarding fundamental rights" around privacy, "freedom of expression and information," and "mitigat[ing] the risks… including for disinformation campaigns."

The Need for Perceptual Human Rights Governing Everyday AR

As AR headsets are an emerging technology, guidelines regarding ethical usage of this technology (for example, around XR privacy, human rights,[13] neurorights,[14] freedom of thought, etc.) are beginning to emerge, although there remain questions regarding whether new rights are indeed required, or whether we are missing an appropriate interpretation of existing rights and legislation to this new technology.[15]

However, at present, it would seem that existing digital human rights do not sufficiently address the exposed vulnerabilities of everyday AR. Nor do proposed digital and neurorights[14] take into account the unique affordances and impact of AR and perceptual mediation. The societal benefits and challenges discussed thus far raise fundamental questions around the permissibility of applying, and perceiving, a given augmentation, and to what extent everyday AR might be allowed to survey, react to, and mediate our perception of reality. Consequently, we could imagine defining a host of new human rights to govern this technology, around *perceptual autonomy* and the right of individuals to control what they perceive; *cognitive autonomy*, tensioning the right to free will and independence of thoughts, attitudes, behaviors and actions against the use of cognitive enhancements that influence or manipulate our behavior; and *perceptual integrity*, establishing what stakeholders have the right to augment property, media, people, places, and more, and whether there is a need to preserve a common objective reality that we all perceive.

We argue that there is a pressing need to consider the challenges posed by everyday, pervasive, ubiquitous AR. This will require a multidisciplinary effort to further map out the vulnerabilities and harms posed by such a technology. We then must test the applicability of existing rights and legislation to mitigate these vulnerabilities. *If* gaps are identified, ultimately we need to arrive at a consensus around the definition and scope of proposed perceptual rights that can protect both AR users and bystanders from individual and institutional misuse and abuse of widescale perceptual mediation. And, crucially, we must do this *before* fruition and mass adoption—with the clock now ticking. Otherwise, everyday AR risks opening up a new front in the conflict between technology and society, enhancing the capabilities of bad actors to enact technology-based coercion, manipulation, deception, censorship and information disorder, and we will find ourselves unable to look away. ■

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Joseph O'Hagan is a lecturer in the School of Computing Science at the University of Glasgow, G12 8QQ Glasgow, U.K. His research is in human–computer interaction, extended reality technologies, and cross-reality interactions. O'Hagan received a Ph.D. in human–computer interaction from the University of Glasgow. Contact him at joseph.ohagan@glasogw.ac.uk.

Jan Gugenheimer is an assistant professor (W2 TT) of computer science at TU Darmstadt, 64277 Darmstadt, Germany. His research focuses on upcoming social challenges for mixed reality technology and how to embed extended reality safely into the fabric of our daily lives. Gugenheimer received a Ph.D. in human–computer interaction from Ulm University. Contact him at jan.gugenheimer@tu-darmstadt.de and www.gugenheimer.com.

Florian Mathis is a senior researcher at the University of St. Gallen, 9000 St. Gallen, Switzerland. His research explores how assistive mixed reality technology can support people with visual, cognitive, and hearing impairments to participate fully and autonomously in society. Mathis received a Ph.D. in usable security from the University of Glasgow. Contact him at florian-mathis@outlook.com.

Jolie Bonner is completing her M.Sci. degree in human–computer interaction at the University of Glasgow, G12 8QQ Glasgow, U.K. Alongside her studies, she has found a focus on researching human–computer interaction topics relating to responsible and impactful innovations in the tech field. Contact her at joliebonner@gmail.com.

Richard Jones is a senior lecturer in criminology at the School of Law, University of Edinburgh, EH10 5HF Edinburgh, U.K. His research interests include cybersecurity, cybercrime, surveillance, and the use of new technology in crime prevention, policing, and criminal justice. Jones received a Ph.D. in criminology from the University of Cambridge. Contact him at richard.jones@ed.ac.uk.

Mark McGill is a lecturer in the School of Computing Science, University of Glasgow, G12 8QQ Glasgow, U.K. His research anticipates and explores the societal impact, benefits, and harms that the mass adoption of wearable mixed, augmented, and extended reality technology poses, from productivity to privacy. McGill received a Ph.D. in human–computer interaction from the University of Glasgow. Contact him at mark.mcgill@glasgow.ac.uk.