

BOOK REVIEW

Embodied Computing: Wearables, Implantables, Embeddables, Ingestibles, Isabel Pedersen and Andrew Iliadis (eds) (2020) 288pp., US\$35.00 paperback, MIT Press, Cambridge MA, ISBN: 978-0262538558

Body-centrism: bridges and boundaries

‘Embodied computing’ is defined by the editors of this volume as ‘body-centred computing’ which sets a precedent for chapters to consider digital technologies *vis-à-vis* their relationship to animal bodies ‘through computational materiality and, more importantly, passively embodied in the user’s enhanced body’ (p.5). The term challenges broad perceptions of the ‘weightlessness’ and ‘lightness’ of technologies (the non-corporeality of digital information) in a manner akin to comments made by Donna Haraway’s rearticulation of the cyborg as an embodied figure (Haraway, 1991, p.154). Indeed, Haraway’s cyborg figure, alongside other feminist new materialist theorists, such as Rosi Braidotti (2013), is alluded to by some of the contributors to the volume, notably in attempts to characterize complex human-technology assemblages wherein:

Humans are inextricably intertwined in the physical as well as symbolic contexts in which they live. Their bodies extend beyond the fleshly envelope into the environment, and the environment likewise colonises their bodies. As such, humans are always inevitably ‘blended bodies’ as they gather with other humans and with nonhumans. (p.51)

The contours and consequences of such ‘blended bodies’ are discussed in the chapters of this volume, and they will be briefly examined here in this review.

One of the immediate things presented by the conceptually (and materially) blended bodies of embodied computing is the question of the boundary (indeed, the boundedness) of the body. For some, such as Pedersen, the border is effaced by technologies (p.35); Iliadis asserts that ‘the user does not necessarily *interact* with the environment but *becomes* the environment’ (p.6) (see Pepperell, 2003). Here, there is no radical separation between self and other (i.e., not-self) because of the ways that our embodied existence is about interactions; we are defined at the porous boundaries that we try – in vain, according to these views – to guard and police. Like digital devices that are interconnected (i.e., through the ‘internet of things’) and indeed continuous with these devices (which is a point that is integral to the ontology proposed by embodied computing), bodies open us up to different encounters and transformations.

Porosity and entanglements between bodies and technologies can be expressed, as they are throughout the volume, prepositionally: for the editors, ‘taken literally, the term embodied computing explores the ways that technology manifests itself on, in, and around an animal body’ (p.xvii). These prepositions are important: embodied computing includes devices that sit above the skin boundary (such as wearables) alongside those that traverse this boundary, namely ‘embeddables’, ‘ingestibles’ and ‘implantables’. Meanwhile, other technologies that manifest around a body (e.g., computing devices) are also revealed to have a material impact, if not on our bodies themselves, then on our embodied interactions in the world. Taken together, these prepositions locate bodies not only among technologies but, perhaps more concisely, as objects in a technological ecosystem (a technosystem of sorts). Katina Michael *et al.* describe this in their chapter in positing that ‘the reach of technology now can extend from the sky (surveillance) to the street (“dataveillance”) to the person around you (“sousveillance”) to within you (“uberveillance”), and back to the sky’ (pp.116–17).

The multifaceted reach of technologies on, in and around bodies correlates with these multiple forms of surveillance, which render new parts of our material, embodied experiences as visible, knowable and even changeable.¹ The emphasis here falls on data generated by bodies and that impact bodies such that, in spite of claims about entanglements between bodies and technologies, ‘body-centrism’ approaches bodies largely as ends and computing devices largely as means. This invites a derivative set of questions about the ethics of the interactions and entanglements between bodies and technologies.

Questions about who gains access to these data and how they are used are the subject of much ethical scrutiny in this book. There are many concerns about users being alienated from their own bodies as data begin to reveal more about them, effectively exposing them to external companies and agents. Elizabeth Wissinger even claims that the user is a victim (p.192). These concerns sit uncomfortably alongside optimistic visions of embodied computing as ‘the enhanced activity of the user’s body’ (p.6), which is suggested by Iliadis and calls to mind ideas of gains for the embodied user. Ambivalence between the two positions is in many ways an inevitable result of the conflation of different prepositional technologies, which brings the location and locatability of bodies into question as they are engulfed and enmeshed amidst various systems and devices. Navigating such a complex ontology, and discerning our own embodied, technologized experiences within it, necessitates reflection on the ‘physio-psychological border’ (p.118; cf. Perakslis *et al.*, 2016) and the perceived limits of oneself. The question of one’s limits is central to the landscape of embodied computing (if there can be a centre),² and is the foundation and stimulus for reflections across the volume. In what follows, I trace and critique responses to this key issue through its implications for selfhood and ethics, which each reveal assumptions about our relationships with (our) bodies and the reconfigurations of these relationships in a technosystem.

Extensions or invasions?

Marshall McLuhan (2001, pp.3–4) once wrote that technologies, as media, are extensions of humans. This reaching outside of oneself through technological appendages that are figured as conduits for personal autonomy and efficacy means that technologies centre and expand material and bodily experiences. To this end, Kevin Warwick, the ‘Captain Cyborg’ who implanted a chip in his own arm (see Orlowski, 2012; Dragan, 2018), discusses how his experimentation with technology in the late 1990s and early 2000s was a form of enhancement,³ and in his work, including his chapter in this volume, there is emphasis on the body through repeated references to the use of surgical methods to implant chips and devices and annexe them to neurological systems. The possibilities brought about by these mediational technologies reach their apotheosis in transhumanist ideologies that, as Maggie Orth summarizes, are espoused by people who ‘want to radically modify their bodies and minds through technology, whether it be chemicals, hormones, electronics, prosthetics, or gene manipulation like CRISPR’⁴ (p.218). Transhumanism (which is also referred to as

¹ In her chapter, Pedersen notes that patients may become ‘subordinate and objectified, while automated processes ... have agency’ (p.33).

² While Pedersen discusses how speculative models for embodied computing locate ‘an imaginary subject as an ideal centre, amid a network geared to surround her’ (p.37), Jethani critiques the design thinking that imposes conditions through embodied devices rather than fully factoring in users (p.177). When it comes to the centres issue in embodied computing and where to locate them, we find that it is unavoidable yet unresolvable, and we must satisfy ourselves instead with Iliadis’s broader position that ‘the body has a fundamental role to play in the production and manipulation of information’ (p.3). This is certainly a reading of which I approve.

³ To be sure, Warwick refers to therapy as well as enhancement. The distinction between these two is important yet one I do not discuss in this review, as both therapy and enhancement are conducive to the same point about Warwick’s emphasis on the individual and the body (see Peters, 2006).

⁴ Clustered regularly interspaced short palindromic repeats

‘Humanity+’⁵) is often associated with the cyborg, with Warwick calling attention to what he regards as the characteristic ‘integrated system with capabilities different to and beyond the norm for a human’ (p.71). The seamlessness or even the convincingness of such integrations, however, is something that is brought into question in the volume in the light of the tensions that accompany the complex entanglements between bodies and technologies. Orth, for example, goes on to say that transhumanists ‘have little squeamishness or reverence for the sanctity of the body and mind’ in their longing ‘to become cyborgs’ (p.218). What does this mean for the corporeal aspect of the eponymous embodied computing discussed in this book?

One of the things that is particularly telling in Warwick’s (auto)ethnographic ruminations on cyborgs is that, for him, ‘the critical part is that the brain is involved in the transition [to becoming a cyborg], rather than any modifications merely in the form of some physical addition’ (p.73). In other words, Warwick prioritizes the neurological even in his emphasis on embodied technologies; it is, somewhat counterintuitively, transformations for one’s sense of self rather than their body *per se* that are important and instructive in making them a cyborg (p.72).⁶ Warwick’s discussion of Neil Harbisson’s work on the Eyeborg project illustrates this: Harbisson, who was colourblind, developed and wore a head-mounted camera that translated colour frequencies into sound frequencies, allowing him to experience colour in a new, technologized and synesthetic way (p.80).⁷ Warwick’s treatment of the technologized cyborgian body is thus predicated on a dualistic and Cartesian understanding of the body, which distinguishes body from mind, and subjugates the former to the latter, with one’s sense of self primarily associated with the neurological. Although Warwick’s treatment of the cognitive is rooted in the material, his work has connotations of dualism, which can be illustrated by everyday attitudes to bodies and discourses about having a body (see Cassam, 2011; Wehrle, 2020). Embodied computing might have somewhat less to do with the body than we might expect.

Warwick’s emphasis on the self is replicated in other chapters, albeit without the same kind of optimism about the benefits and services directly to users that are perceived of digital technologies. Indeed, as we have seen briefly, there is much scepticism among the contributors about encroachments rather than enhancements brought about via technologies. These include the ways that devices, such as microchip implants, ‘are in reality a technology of controls, limits, and rights’ (p.102) producing what Iliadis refers to as ‘new power asymmetries with external regulators’ (p.6). Technologies developed and sold, and ultimately used, by companies give more corporal and intimate access to our corporeal selves, which in turn transforms the status of our bodies and our own relationship with them. In other words, it is our sole sovereignty of our bodies that is at stake.

Wissinger’s comment, ‘your most personal identifying characteristic, for instance – your DNA – enjoys few legal protections once it leaves your body’ (p.204), casts light on this predicament: the body was once seen neatly to demarcate selves and was a readily available container for

⁵The label ‘Humanity+’ attests apply to the continuities and discontinuities between humans and transhumans that were introduced originally by Julian Huxley’s use of the term ‘transhumanism’ to refer to ‘man remaining man, but realising new possibilities of and for his human nature’ (1957, p.17). The resonances between humans and technologies that are recognized alongside the changes that the latter bring about for the former invite tensions that I discuss here in relation to bodies (see Midson, 2018, pp.105–11, 119–23).

⁶Warwick’s neurocentrism is noted in Orth’s chapter where she muses ‘and if our phones and their addictive software can cause such unplanned radical behaviour changes, imagine the unintended psychological consequences of brain implants, devices that will trigger our pleasure centres, control our bodies, and perhaps most significantly, connect us to other minds’ (p.227). Orth here demonstrates a kind of slippery slope argument that corresponds to the latent neurocentrism in much of our thinking about our bodies and technologies.

⁷Interestingly, Warwick then refers to Rob Spence’s alternative Eyeborg project that replaced a lost right eye with an eyeball-shaped camera that ‘is not connected to his [Spence’s] optic nerve and has not restored his vision in any way’ (p.81). By Warwick’s own criteria, Spence’s appendage would not render him a cyborg yet this is not highlighted by the author, and so it is not clear what this example reveals – or perhaps even undermines – about Warwick’s definition of cyborgs.

individuality. However, by opening up the body through technologies, notions of inner and outer are undermined by an emphasis on the relational exchange of data and materiality at the liminal, technological site of the body. Two trends are significant: (1) the body is taken as an object that is transformed by technologies; and (2) the technologized body is taken as a means for reassessing notions of monistic and discrete individuality, and in particular the legal systems that are predicated on such notions. In both cases, technologies are agential, ubiquitous and transformative: whether invaded or extended by technologies, the porous and malleable body demands reconfiguration and reconceptualization, which raises new questions about individuality and selfhood. Indeed, we might therefore say that the underlying concern about access to and governance of the body is, at root, a concern of and for the self, whose body, once figured as opaque, discrete and solely their property, is rendered porous through a myriad of computational technologies that, according to Orth, result in an exposed self (p.229).

This is not to say that the book adopts an entirely pessimistic or even, in Warwick's case, optimistic stance with regard to embodied computing and its impacts on the self. As the editors remind us, there are 'multiple forms of body-centred computing' (p.xxviii), and so, while some theorists of embodied computing use the language of invasion and infiltration to refer to the impact that technologies have on bodies and embodied senses of selfhood, not all follow suit. To be sure, there is a tone of caution that pervades across nearly all chapters as embodied computing is located within various 'social, ethical, and political frameworks' (p.188), but that caution is tempered through critical questions that can be raised of the relationship among persons, bodies, and technologies. We glimpse such questions and cautiousness where Iliadis states:

It would be useful to consider the future forms of visceral data generated by ingestibles and to unpack the ways in which those data may be operationalised against the best interests of the users to whom those data belong. (p.12)

How we consider and discern what a user's best interests are, in the context of relational and digital ontologies, can cast light on what the book says about embodied computing and what reflections we can take from its explorations.

From know thyself to show thyself

At the same time that embodied computing explodes the concept of the body as a discrete marker of individuality, inviting new materialist explorations of the porous and relational body – and with it, perhaps, new notions of selfhood – there is also a concomitant emphasis through embodied computing on what Wissinger refers to as 'newly invasive and individualised data' (p.189). In other words, the self, rather than being overtly challenged by new technologically mediated relations with other corporeal selves and corporations, is revealed and in fact reified through its quantified and bodily data. Embodied devices containing trackers, from smartwatches to toothbrushes, generate data that are marketed to consumers as benefiting and enhancing their self-control (consider here the rhetoric of campaigns from Apple (Better you) and Samsung (Do what you can't)),⁸ allowing them to get more out of their bodies. Marcel O'Gorman characterizes these trends around the quantified self as the apotheosis of Taylorism (p.138), where Taylorism is about scientific management in the interests of efficiency and productivity. Quantified bodies here are thus figured as disciplined objects and the outcome of a user-technology hybrid assemblage that is both individual and social, at once the product of corporeal processes and corporate interests.

⁸The likes of which were astutely parodied by the advert promoting Charlie Brooker's Channel 4 series *Black Mirror*, which examines the shadowy side of our relationships with technology through repetition of the word 'more' (<https://www.youtube.com/watch?v=ke5AKVtvkdc>). (For Apple's advert, see: https://www.youtube.com/watch?v=0cBJBj_tBHM; for Samsung's advert, see: <https://www.youtube.com/watch?v=lgCP154Ojy8> (accessed January 2022)).

Within these frameworks, it is difficult to locate agency. Wissinger, for example, identifies what she terms ‘glamour labour’, which she describes as ‘the work of self-branding and control to become as attractive, exciting, and engaging in person as one’s highly curated and edited online self’ (p.188). This process suggests a sense of agency on the part of users in a manner not dissimilar to Erving Goffman’s (1990) articulation of how people ‘perform’ their sense of self to different audiences, albeit in the more chaotic and accelerated landscape of social media. It is the technological ecosystem of social media and other digital devices that Wissinger indicates is impactful on and inimical to our sense of agency insofar as ‘wearable tech pushes the envelopes of tracking and optimisation, amplifying how technologically enmeshed bodies are metered, nudged, cajoled, protected, and connected’ (p.194). To be sure, Wissinger is not pessimistic in her outlook – protection and connection, which have positive yet oxymoronic connotations, are among the words that she uses – but the efficacy of technologies and the technosystem to condition bodies through norm enforcement upon the self is certainly highlighted.

Are users, then, acting through their bodies and technologies? Are technologies and the companies designing them conditioning users and their bodies? And in turn, do we learn more or less about ourselves via technologies? Do technologies mediate our bodies more indirectly, thus alienating us from them, or do they tap into (and meanwhile transform) our intimate experiences of embodiment? These are the questions presented to us by embodied computing. The book is not especially concerned with answers to these questions; rather, the contributors focus on addressing the appropriate contours of these questions, reminding us of the multifaceted aspects of embodiment and the ways that technologies can be appropriated by consumers (which is Wissinger’s focus), imposed by producers (which Jethani highlights), as well as the many ways in which they mediate and even conflate categories of consumers and producers.

Before reflecting on these entanglements and conflations in closing, it is worth examining a notable instance in the final chapter of the volume where answers to some of these questions are experimentally and, in my reading, dramatically offered. In her chapter, Orth critiques those she regards as ‘TechnoSupremacists’, a group comprising technologists and their followers who advocate that ‘all problems – whether generated by society or by the unintended consequences of their own inventions – are best solved through the creation of more technology’ (p.211). This form of techno-solutionism resonates with Warwick’s utopian hopes of becoming cyborg in accordance with a transhumanist ‘if you can’t beat ’em, join ’em’ philosophy (p.90). This goes beyond the tacit technological determinism identifiable throughout the book to argue explicitly and emphatically for the widespread use of technologies for human purposes. Orth is avowedly sceptical of this ‘TechnoOptimism’ and the risks of unforeseen and unintended consequences that can be brought about by technologies (p.225), but she then makes a striking U-turn when it comes to her own embodied self: ‘Would I open the lid of my mind, risk the angry voices that lurk in these devices, to better know myself? You bet I would’ (p.230). How does she reach this conclusion, and what might this reveal about attitudes to embodied computing?

Two things appear to be salient in Orth’s conclusions: (1) the desire to remain in some way human (p.230); and (2) an emphasis on the individual gains that technologies can bring about for her. In Orth’s own words:

I would still choose the novelty of new technologies and the expanded short-term sensual experience they promise me as an individual, while ignoring the long-term external dangers they create, including environmental collapse and the transformation and possible destruction of humanity. (p.230)

Orth recognizes this individual-centric mentality as part of the problem that we face overall *vis-à-vis* our technosystem, which she presents as combatable through a need to look beyond immediate and novel gains in favour of more sustainable measures and goals (p.230). We have been conditioned, she suggests, to prioritize the proximate and the self, which is one important aspect of the systems and devices that comprise the landscape of embodied computing.

Although in a sense surprising, I find Orth's comments to be characteristic of the broader arguments about selves, bodies, technologies and others (i.e., other selves and companies) and the ways that data (and power) flow between these agents that pervade discussion throughout the book. Framing this discussion, the editors describe how the book sets the task of 'coming to terms with untangling this predicament', namely, the treatment of 'humans as data blended entities' (p.xvii). On the one hand, there is here a recognition of ways in which the notion of what it is to be human is changed via embodied computing technologies and the data co-produced by these devices and the body. To the extent that Orth anticipates how 'these devices may lead to the better understanding of others, and ultimately ourselves' (p.229), she appears to acknowledge a hybrid ontology whereby technology is so deeply enmeshed with our lives and so blended with our bodies that it is no more or less of a screen or window to ourselves than our own bodies are. For many posthumanist thinkers, this changes how we understand what it is to be human, but it doesn't necessarily make us more or less human.

A different reading is possible, however, if we consider technologies to be invasive and therefore as risking making us less human, less individuals or less ourselves. To the extent that the editors go on to question in the introduction whether bodies should be thought of 'in terms of levels, both corporeal and abstract, as data-blended entities that are susceptible to outside manipulation, surveillance, and control' (p.xxii), we find more conservative analyses of technologies that jeopardise something of the relationship between the self and the body. Attempts to disentangle deeply entwined relationships, and to discern different levels, reintroduce the possibility of conceptualizing a bounded self that is being approached, even invaded, by external groups. This, we find, is the axial point on which evaluations of embodied computing turn: as Orth's ambivalent analysis most explicitly shows, approaches to embodied computing appear to be at the nexus of ontologies that are transitioning towards a new hybrid model of humanness, alongside ethics that are wedded to notions of individuality and selfhood. New technologies are ushering in new perspectives, but we perhaps find ourselves at a liminal cusp of working through the implications of these changes to ourselves, our bodies and our attitudes.

Final comments: bodies and/as media

In summary, the chapters in this volume, like the bodies they describe and analyse, are consistently and collectively struggling with the ambivalence and liminality between materiality and immateriality; expansion and intrusion; means and ends. These tensions correspond to broader themes across interdisciplinary science and technology studies about the relationship between the human and the technological, and the individual and the societal, which are encapsulated by the notion of the cyborg and its relationship to different evolutionary and critical frameworks of posthumanist thought (Midson, 2018, pp.71–89).

Certainly, this volume as a whole argues that the body is a site of contestation and negotiation – it is a collaborative project among different individual, corporate, social and technological actors and agencies – and we realize at the nexus of various relationships and tensions that neither the bodies nor the technologies, nor indeed the data that they co-produce, are neutral. To be sure, consideration of how bodies are commodified and repackaged through technologies – indeed, as technologies – calls us to be cognizant of how all computing is, in a sense, embodied computing. Bodies in this sense reach and extend inwards and outwards, both connecting and separating self and society, and it is here where we find some of the most pressing ethical and political concerns about privacy and autonomy, both matters of internality and externality, for our embodied information age.

It is with that in mind that I find Pedersen's reference to bodies as 'media' (p.24) to be a particularly apt characterization of the ideas in the book, insofar as bodies and the data that they leak are seen as conduits for self-expression, corporate interests and technological intervention. The chief concern is with that which is mediated by the body, while also being mindful of how the

medium is the message (McLuhan, 2001). We find lots of different messages intercepted by the contributors to the book, and with them, lots of different possibilities for our experiences of embodiment in a technosystem – or, put differently, for embodied computing. Of course, in addition to the body that is permeated by technologies, that technologically determined framework can and should itself be examined and scrutinized, uncovering how it is permeated by bodies, in order to uncover yet more messages that speak to our pluriform contexts and experiences.

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