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IFOW Institute for the Future of Work

Data on our minds: Affective computing at work

Affective computing
(n): a field of computer programming focused on creating and programming machines to both 'demonstrate' emotions, and to recognise and respond to, human emotions.

Algorithmic affect management
(AAM) (n): building on 'algorithmic management' (AM), the use of workers' affect and emotion data to feed into algorithmic management systems.

Contents

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Summary

We identify **a new frontier in the rapid development and applications of inferential biometrics-based systems at work**. This frontier marks a shift in the scope, manner and bases for managerial decision-making, as wide-ranging, automated inferences, classifications and measurements relating **to intimate details about who a person is and how they are likely to behave** become more significant. We call this 'Algorithmic Affect Management' (AAM). We find that AAM has significant **regulatory implications across domains**, from definitions to the need for specific, updated protection in both hard and soft law. We find that such a **multi-layered, systems approach**, covering both individual and group impacts, is required to adequately protect working people.

Our research points to the need to mandate robust **due diligence, auditing, monitoring and mitigation** provisions on responsible actors who should report on significant risks and impacts – including from AAM at work – across supply chains and the AAM life cycle.

In addition to clarifying the application and enforcement of existing protection, we also recommend public consultation on the development of new, freestanding rights to explicitly protect against **'neurosurveillance' and the use of AAM to manipulate, interfere or commodify** workers' cognitive, emotional and behavioural functions and capabilities.
We see this as an extension and application of fundamental human rights, labour and health and safety protection, with particular regard to privacy, human dignity and integrity of the person, in recognition that the new and increasingly intrusive sphere of AAM at work may demand a new category of protection.

Regulators, the DRCF and the Fair Work Agency will need additional resources to consider and collaborate on governing AAM at work, investigate use cases, share insight, support AAM literacy and develop this dual approach.

Introduction

Digital profiling using algorithms and datasets is becoming more and more pervasive in every aspect of life. Alongside our experiences as consumers, citizens and patients, the accumulation of data and technological monitoring is increasingly focusing on people's behaviour and activities in the workplace.

Monitoring and tracking practices were common in factories in the late 20th century, where punch cards were used to ensure that workers were paid for the number of hours they worked. This monitoring has now expanded to include more and more types of worker behaviours, including moods, emotions, and a range of physiological conditions.

The project on which this report is based has interrogated these novel forms of monitoring to measure work and work-related behaviour and activities. The aim has been to better understand the known, emerging and rising risks and benefits for workers when new tracking and monitoring technologies are integrated into working environments. Some of these are creating new health and safety risks, while improved work processes and design, conditions and quality may also be achieved.

Our focus has been on biometric technologies – measuring *physiological* signals – and 'affective' technologies – which are designed to measure *psychological* states of workers, and how these are applied to manage workers in new ways in what we are calling 'Algorithmic Affect Management' or AAM. We identify what functionalities and purposes they have served within the disciplines of computer science and sociology, then assess how the newest trends are being picked up in legal and social science disciplines. This has allowed us to identify how AAM should be understood and critiqued in the context of work.

To ensure rigour, we consider 'affective computing' in a historical context, exploring how affect tracking technologies reflect a particular phase in artificial intelligence (AI) research. Our findings are based on a literature review of primary and secondary literature, data and field-based semi-structured interviews, which we have integrated with findings from two new surveys.

To ensure that our findings can inform current debates on the regulation of employment, working time and equality – as well as health and data – we have also reviewed the approaches that employers are taking to assessing the time that people spend working. While working time has been closely tracked for many years through swipe cards, log-in data, or self-reporting, our research shows how this has intensified as tracking of workers' emotions, feelings, sentiments, and a range of biometric and physiological measures are being *cross-referenced* with records of sickness, occupational health information and performance targets. The scale and aggregation of this data – and the ways it is being analysed and used to make decisions about work and workers – have not been seen before.

Introduction

Workplace monitoring or 'surveillance' has a long history. Even as far back as 2006, a report for the UK's Information Commissioner's Office (ICO) noted that, 'It is pointless to talk about surveillance in the future tense… everyday life is suffused with surveillance encounters, not merely from dawn to dusk but 24/7' (Ball and Wood, 2006).

A 2019 survey of 239 large corporations found that more than half were using some form of 'non-traditional monitoring', including analysis of the text of workers' emails and social media use, scrutiny of meetings and gathering biometric data (Gartner, 2019).

The Covid-19 pandemic accelerated the rise of remote working and a reduction in human contact, and with this the prevalence of management-led data gathering. One study found the use of 'bossware' increased three-fold (Klosowski, 2021). Beyond keeping tabs on worker productivity and work behaviours, the rationales offered by companies have ranged from protecting occupational safety and health (OSH) and monitoring wellness and fitness to protection of trade secrets and cybersecurity, and productivity optimisation.

The use of AAM presents deeper ethical and social questions, in particular around how such close and sustained exposure to affective technologies could be interacting with ontology, fundamentally changing how we see ourselves and our relationships to one another.

Further arguments supporting digitalised worker tracking are that it improves team performance, can lead to worker 'mindfulness' (where workers know they are being monitored), and can help managers spot deviant off-site behaviour by providing information about worker locations via GPS and other systems. These stated benefits are promoted as innovative and cost-effective (Johnson, 2024).

However, the addition of Affective Algorithmic Management (AAM) to 'bossware' products has introduced new types of 'affective' tracking which can be integrated into existing information and communication systems. For example, the German business process management platform SAP collaborated with the neurotechnology company Emotiv to integrate a computing interface to analyse workers' brain states and give real-time feedback on stress levels to employees and their managers (Italia, 2019). Microsoft's Co-Pilot can be configured to allow employers to monitor workers' health with an integrated 'wellbeing' function (Patton, 2023). The video conferencing tool Zoom has added a feature that detects emotional states via Emotion AI, which 'involves machine learning to detect and analyse human emotions, typically through facial expressions, voice tones, and body language' in virtual communication (Morphcast, 2024; Mediawize, 2023).

While tracking and monitoring working time to ensure fair pay is long-established in factories and other workplaces, these affective measures present new challenges, especially when they feed into algorithmic management systems that may make automated or semi-automated decisions that could impact access to work, pay, conditions and other aspects of work quality (Soffia et al., 2024). These 'computerised' decisions may be presented with an 'air of rationality or infallibility and people might blindly follow them' (Beer, 2017), even where they derive from intimate and subjectively experienced emotions and perceptions. (Borgesius, F. Z. 2018; Scherer 2021).

Introduction

In the workplace, such monitoring raises novel challenges to privacy. It can also drive other risks and impacts from health and wellbeing and dignity to workplace inequalities, and inform a host of other important decisions about work, including its design, organisation – and the type of automation that may be possible (Gilbert 2023, Gilbert and Thomas 2021).

Beyond this, the use of AAM presents deeper ethical and social questions, in particular around how such close and sustained exposure to affective technologies could be interacting with ontology, fundamentally changing how we see ourselves and our relationships to one another.

The aim has been to better understand the known, emerging and rising risks and benefits for workers when new tracking and monitoring technologies are integrated into working environments.

This report examines these AAM-related challenges and opportunities. It is structured as follows:

Section 1
Affective computing: from AI subdiscipline to worker tracking technologies

In this section we analyse the literature and 'state of play' in research around 'affective computing' and begin to explore how and why specific technologies are being integrated into working environments.

Section 2
Algorithmic Affect Management: Evidence and impacts of use

This section presents research into how, and where, AAM is being integrated and assesses known risks and impacts. We include descriptions of specific AAM technologies and evidence from two surveys. We pay particular attention to 'technostress', the boundaries of surveillance and the risk of spilling over into the commodification of human emotions.

Section 3
Algorithmic Affect Management: what is being measured, and how can this data be used?

This section presents more detailed use-cases, exploring what AAM software and hardware sets out to measure and what promises are being made about functionality. We examine more obscure risks, indirect impacts and the unexpected consequences that AAM may engender.

Section 4
Conclusions: Provocations for policy and research

Drawing this together, we conclude with recommendations for policy and practice. We explain why the existing patchwork of legal frameworks is inadequate, how the UK can be a global leader in the regulation of AAM and propose options for consultation. These could be incorporated as part of the forthcoming Employment, Data, AI or Equality Bills, and developed in secondary regulation, alongside domain-specific codes and programmes to boost AI/AAM literacy.

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Section 1

Affective computing: from an AI subdiscipline to worker tracking technologies

The problem of measuring emotion

Affective computing is a branch of research dedicated to 1) creating systems and devices capable of identifying, understanding, and coding human emotions and 2) enabling computers to interact with humans in a more emotionally intelligent and empathetic way. Early AI research – as far back as founding ideas in the 1950s – predicted that creating such a sensing machine that could behave like a human would be achievable.

The term 'Affective Computing' was coined in the late 1990s by Professor Rosalind Picard, who is the founder, and director of the Affective Computing group at MIT Media Lab. The group's projects aim to 'make people's lives better', with a purview including ways to forecast and prevent depression, solutions to help those who face challenges in communication, motivation and emotion regulation, and enabling robots and computers to respond intelligently to human emotions.

This range of applications can be summarised into two major fields. The first involves **programming computers to respond to human emotions 'intelligently'**. Intelligent responses to humans' emotions by machines has been hoped to be therapeutic for humans. This area of work is most prevalent in disability studies.

The second field – which has a wider uptake across different industries than the first – involves programming computers **to track and monitor human emotions, physical movements, and other physiological aspects of human behaviour**, via biometrics monitoring. It is this second arena of affective computing which has relevance for affective algorithmic management of workers.

There are significant challenges in both areas as humans are capable of having feelings and emotions without displaying these physically, and also have behaviours that are 'unconscious', and may not even be felt or known by the subject. Additionally, humans interact multimodally with emotions meaning that even arriving at a definition for emotion has evaded emotion theorists and scientists. Picard establishes two foundations:

1) emotions are cognitive, emphasising their mental component; and
2) emotions are physical, emphasising their bodily component (Picard, 2000).

However, physiological responses to emotions are not identical across people, and the same response can be triggered by different emotions. An increased pace of heartrate, for example, can result from both negative stress and heightened joy (Picard, 2000). This presents difficulties for machines tasked with ascribing emotions from data captured.

Section 1

These 'Emotional AI' algorithms are trained on datasets, but datasets on their own do not necessarily reflect the culture within which a person has feelings and other physiological expressions, nor their individual dispositions or life experiences.

The coding of emotions for 'Emotional AI' systems involves human choices made by a coder around categorisation. However, cultural, gendered and racial stereotypes have been demonstrated to inform the ways that coders match expression with codes. Different cultures have different norms around public and private displays of emotion, and differentiation between a smile of happiness and a grimace of disgust has cultural and demographic dimensions (Agarwal, 2022).

This has been shown in two emotion-recognition software programs – 'Face' and Microsoft's 'Face API' – which assigned more negative emotions to black players across 400 National Basketball Association (NBA) games, even where they were smiling (Agarwal, 2022). A 2019 UNESCO report noted that digital assistant systems are often assigned feminine voices based on stereotypes of women's servitude (UNESCO and Equal Skills Coalition, 2019).

However, affective computing research has tended to focus on the technical capabilities of systems, and has not routinely asked questions about how the extent to which these technologies are being used to track workers, or what the associated impacts on privacy, equality, wellbeing and occupational safety and health might be. Indeed, research into workplace affective computing is only now beginning to be done. Early findings suggest a very cautious approach; labour lawyer Frank Pasquale argues that its use is likely to lead to 'misrecognition, privacy invasion, modulation, and alienation' (Pasquale, 2024).

The rise of biometric monitoring

Affect tracking occurs via biometric readings – part of a relatively new generation of technologies that aim to identify people by emotion and physiology rather than by personal data such as an address or telephone number. 'Biometric recognition' has a definition provided by the International Standards Organisation (ISO), where ISO ISO/IEC 2382-37:2022(E) is related to 'automated recognition of people based on their biological or behavioural characteristics'(Information Commissioner's Office (ICO), 2024a).

To perform biometric recognition, information about a person's biological, physical or behaviour characteristics is gathered, either directly from a person, or from another source such as a photograph. Biometric samples can include images of faces, recordings of speaking or videos of human movement.

Biometric recognition techniques include:

- facial recognition
- fingerprint recognition
- iris recognition
- voice recognition, and
- ear recognition (ICO, 2024a).

Behavioural biometric recognition includes elements relating to movement, gestures, motor skills seen in handwriting, gait when walking, or even how people's fingers move across a keyboard when typing, as such:

- keystroke recognition,
- handwritten signature recognition,
- gait recognition, and
- gaze-based recognition (ICO, 2024a).

Section 1

Early forms of biometric tracking were seen in fingerprint collection by security forces in the 1950s. DNA identification was increasingly normalised from the later part of the 20th century – and this normalisation was aided by popular television programmes such as 'Crime Scene Investigation (CSI)' which likely contributed to dramatic increases in student enrolment in university courses in forensic psychology, where biometric tracking is involved.

Studies have shown how the terrorist attacks on the USA on 11th September 2001 were subsequently used to justify a significant increase in state funding for biometric tracking to fight terrorism (Shachtmann and Beckhusen, 2013). This led to the accelerated development of biometric tracking using a subject's iris, eyebrows, gait or 'long-range fingerprint'. Even an increase in perspiration was seen as a trackable condition, potentially identifiable as stress, meriting biometric identification by security forces (Shachtmann and Beckhusen, 2013).

Researcher has also been driven by commercial pressures. In one study, 12,000 facial responses to 170 advertisements from a range of markets and product categories were recorded, from 1,223 people (McDuff et al., 2015). Their facial responses were coded frame-by-frame and the results used to 'gain insight into the structure of effective advertising'.

The objectivity, accuracy, precision, reliability, and viability of computational processes used in biometric measurement, are often assumed, rather than scientifically tested.

The rise of the quantified-self movement

The 'quantified self' movement began in the early 2000s in Silicon Valley, where biometric-tracking technologies became commercially available. This allowed people to collect new types of physiological like heart rate, sleep, steps, blood pressure, cognitive alacrity, prayers, menstruation, genetic information, diet, weight, emotions, and mood (Moore, 2019).

People in the quantified self movement claim that they have, over time, discovered personal insights (Lupton, 2016). They claim to be achieving what guru Gary Wolf describes as 'self-knowledge through numbers', ushered in by a 'culture of personal data' where people look for the 'barcode of life' (Wired, 2009). 'Quantified selfers' tend to talk about their experiences with some level of enthusiasm around their activities and tend to enjoy talking to other self-tracker fanatics about getting to know the self that is 'not otherwise knowable' (Moore, 2019).

What these self-optimisation fans have not tended to do is to consider questions about the potentially invasive nature of inferences and profiling as biometric tracking is used by companies or governments (Moore, 2023). Additionally, the objectivity, accuracy, precision, reliability, and viability of computational processes used in biometric measurement, are often assumed, rather than scientifically tested.

While of minimal wider impact for those in the quantified self movement, these questions become significant in other contexts – especially in workplace AAM – given the variabilities in both the methods selected for tracking and the social and professional relationships that surround the methods selected. Connected to this 'self help' ideal of the quantified self movement, worker tracking and monitoring has often been presented as a means of promoting workers' wellbeing. For example, Whole Foods began a worker wellness programme which asked workers to record their weight and food consumption to obtain discounts on

food (Gordon, 2021). Paradoxically, research has shown that this trend towards biometric tracking could be detrimental to worker wellness and psychosocial wellbeing (Gordon, 2021; Moore, 2018; Till, 2019; Kent, 2020, 2023).

Researchers pointed out that often, the problems which are hoped to be solved by tracking technologies – like stress or anxiety, for example – increase with their deployment.

AAM increases 'emotional labour'

Some work and employment researchers have engaged with concepts around 'emotional labour at work' – referring to the way workers engage in work that requires the management of their own emotions and those of their co-workers or superiors (Hochschild, 2003/1983; Brook, 2009; Bolton, 2004).

In one quantitative study on workers' perceptions on Emotional AI, falling under the purview of the conception of AAM as they deploy data-intensive processing to infer emotions about workers, researchers reported that most workers perceive these systems as a serious invasion of privacy, and thus are required to undertake emotional labour in an attempt to regulate their emotions, to protect themselves from such privacy intrusions (Roemmich et al., 2023).

In another systematic review, researchers pointed out that often, the problems which are hoped to be solved by tracking technologies – like stress or anxiety, for example – increase with their deployment (Mantello and Ho, 2023). The same research argued that these adverse impacts are particularly strong among those from more disadvantaged ethnic backgrounds.

Defining wellbeing

AAM is often introduced with the aim of increasing worker wellbeing, however, *what constitutes wellbeing* is narrowly defined by the developers of technologies. This has been named 'bounded wellbeing' – where workers' ability to determine wellbeing is limited by organisational constraints (Tirabeni, 2023). Critics of these technologies have also pointed out that, in work settings, certain emotions are made measurable, or given codes, while others, such as sadness, are not (Littlefield, 2018).

At the same time, corporate wellness programmes associate wellness with 'fitness for work'. As such, these programmes establish a framework within which management expectations are set (Hull and Pasquale, 2018).

With the rise of AAM technologies, it is expected that new definitions and metrics will be needed in the negotiation of the employment relationship. Further, some research has covered the introduction of wearables in work settings to incentivise 'healthy behaviours' while also informing corporate health insurance policies (Ajunwa, 2018).

Wearable tracking technologies contain a specific dimension and function that differentiates them from other worker surveillance technologies because of the increased level of intimacy when a technology is worn (Moore, 2019).

Feminists have argued that social reproductive work, including emotional and affective labour, goes unnoticed and is usually not paid for. Some devices are worn on bodies, which track worker activities that are not immediately understood to be 'work' but are activities that are needed to complete work – such as sleep, staying healthy or eating.

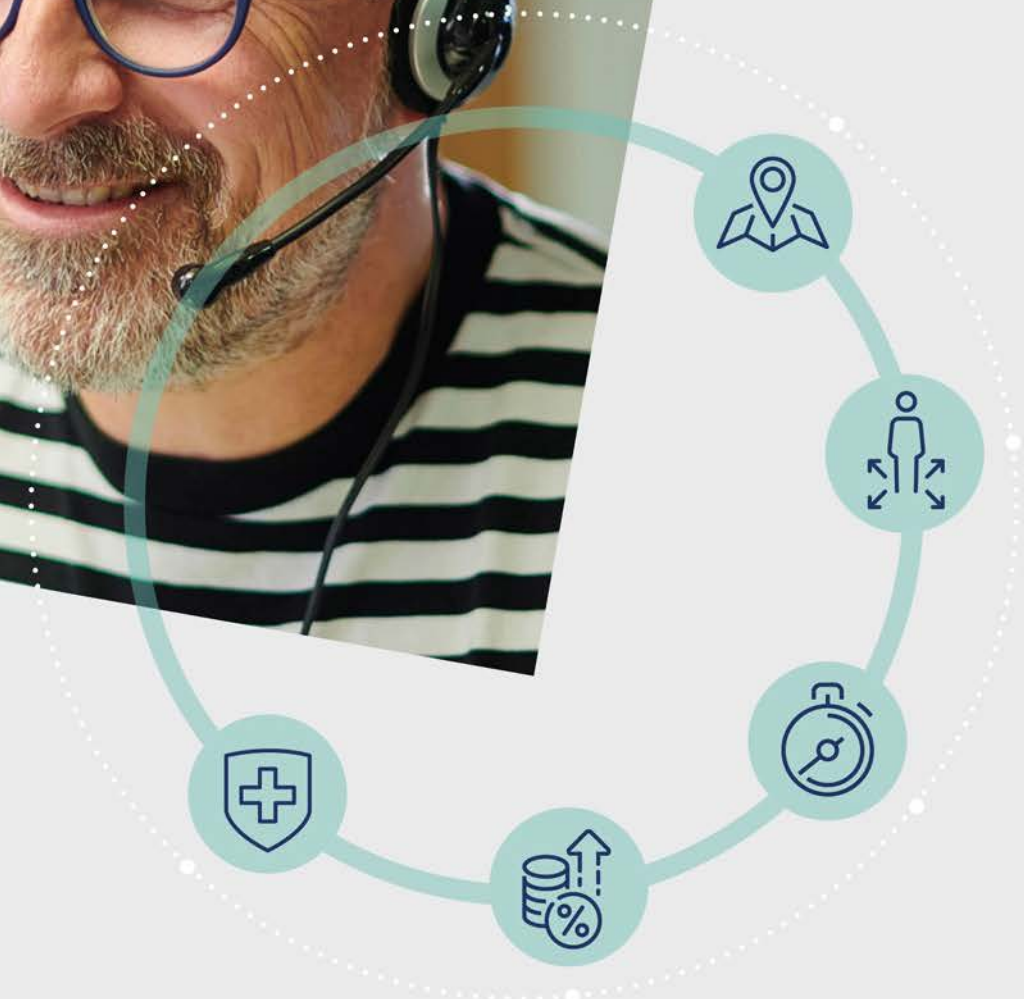
Section 1

There has been considerable academic focus on researching the datafication of work through the conceptualisation of algorithmic management, and analysing the way they transform employment and work-related issues to encompass concerns around automated decision-making, surveillance, facial recognition, and the use of data to manage workers and organise the distribution of work. With the use of algorithms, 'work becomes mediated and organized digitally: algorithms assign tasks and surveil workers' (Delfanti, 2021: 39).

A common feature in these systems is the production of information asymmetries between the owners and operators of technical systems and the workers. Workers have little role to play in shaping and negotiating the terms of data collection and processing, or in the development of the AAM system. Data-driven management's efficacy is reliant on the ambiguity regarding datafication and surveillance.

'Emotional AI' algorithms are trained on datasets, but datasets on their own do not necessarily reflect the culture within which a person has feelings and other physiological expressions, nor their individual dispositions or life experiences.

2



Section 2

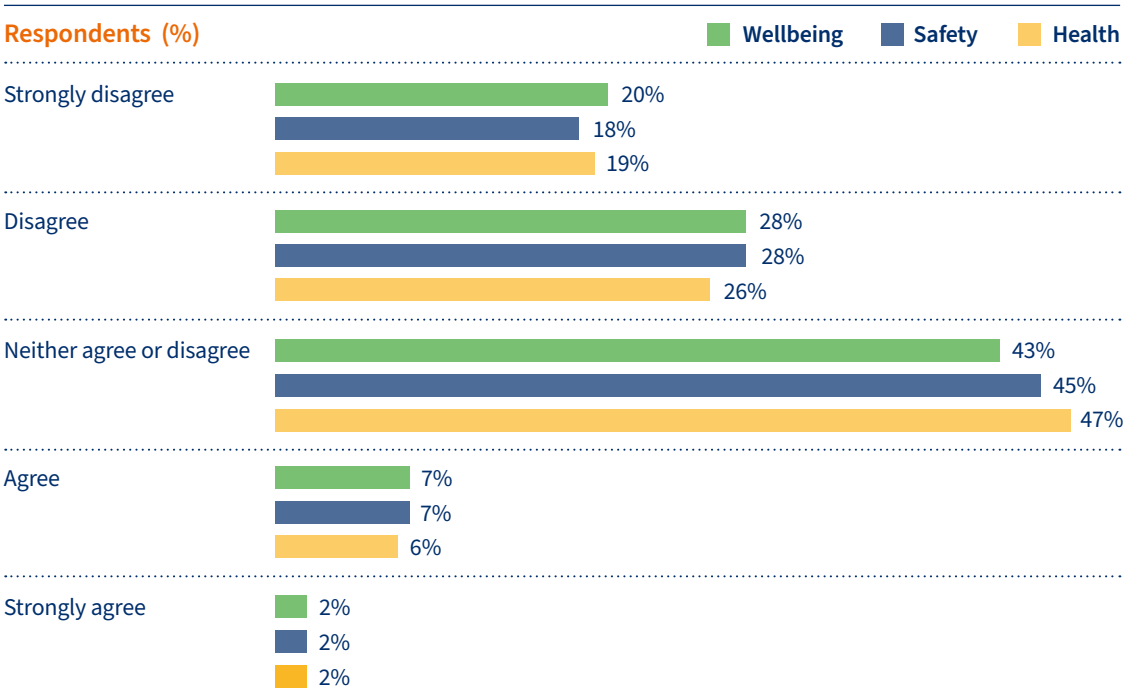
Algorithmic Affect Management: Evidence and impacts of use

This section outlines research into how, and where, AAM is being integrated and assesses known risks and impacts. We focus on the evidence from two new surveys, adding the descriptions of some specific AAM technologies. We also analyse evidence of 'technostress,[1] examine the boundaries of surveillance in the high stakes and constrained environment of work, and consider the risk of spilling over into the commodification of human emotions.

Surveys: The prevalence of AAM in the workplace and the impact on workers

To generate new evidence of the experience and impacts of AAM, we conducted two surveys involving 380 worker respondents who have experienced AAM technologies in 2022–2023. Our surveys focus on technology adoption; psychosocial impacts on workers which involved, based on findings, increases in technostress; and workers' perceptions of employer priorities and rationale for introducing AAM.

Figure 1: Technology which collects data about me at work has made a positive impact on my…



Section 2

Nearly 40% of workers reported experiencing the adoption of technologies which collect information on their affective states, as related to health, safety, and wellbeing. Across all three factors (health, safety and wellbeing), the majority of survey respondents did not agree that AAM has had a positive psychosocial impact. Across each question, around 45% of respondents disagreed that such technologies positively impact their health, safety, and wellbeing. Less than 10% agreed that AAM had a positive impact (see Figure 1).

Worker perception of employer priorities

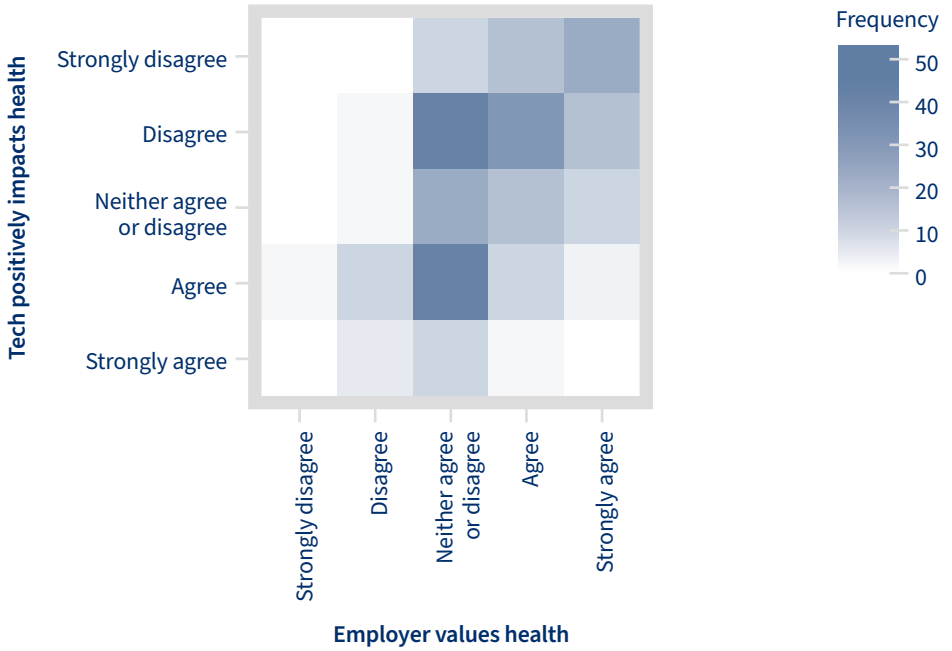
People's negative perceptions of affective technology adoption may be related to their beliefs about employer priorities for the use of AAM in working environments. Workers who thought technology did *not* positively impact their wellbeing and health also believed that their employers did not *value* their health.

However, concerns about technology's impact on safety and wellbeing were not strongly correlated with beliefs about employer priorities (see Figure 2).

The relationship between technology's impact on wellbeing and workers' perceptions of a supportive work environment for discussing and improving wellbeing, may need better linking to the types of technologies that workers are being asked to integrate for an even more granular analysis. While there was some correlation between these two variables, workers who were concerned about technology at work did not feel particularly supported to discuss these issues.

The average response is skewed towards disagreement i.e., respondents do not think AAM technology has positively impacted them in the areas of health, safety, or wellbeing; whether they are valued and respected; or their ability to choose how, where, and when to work.[2] This suggests that workers perceive AAM technologies as *not positively improving* their work lives.

Figure 2: Interactions between technology's impact on wellbeing and workers' perceptions of a supportive work environment



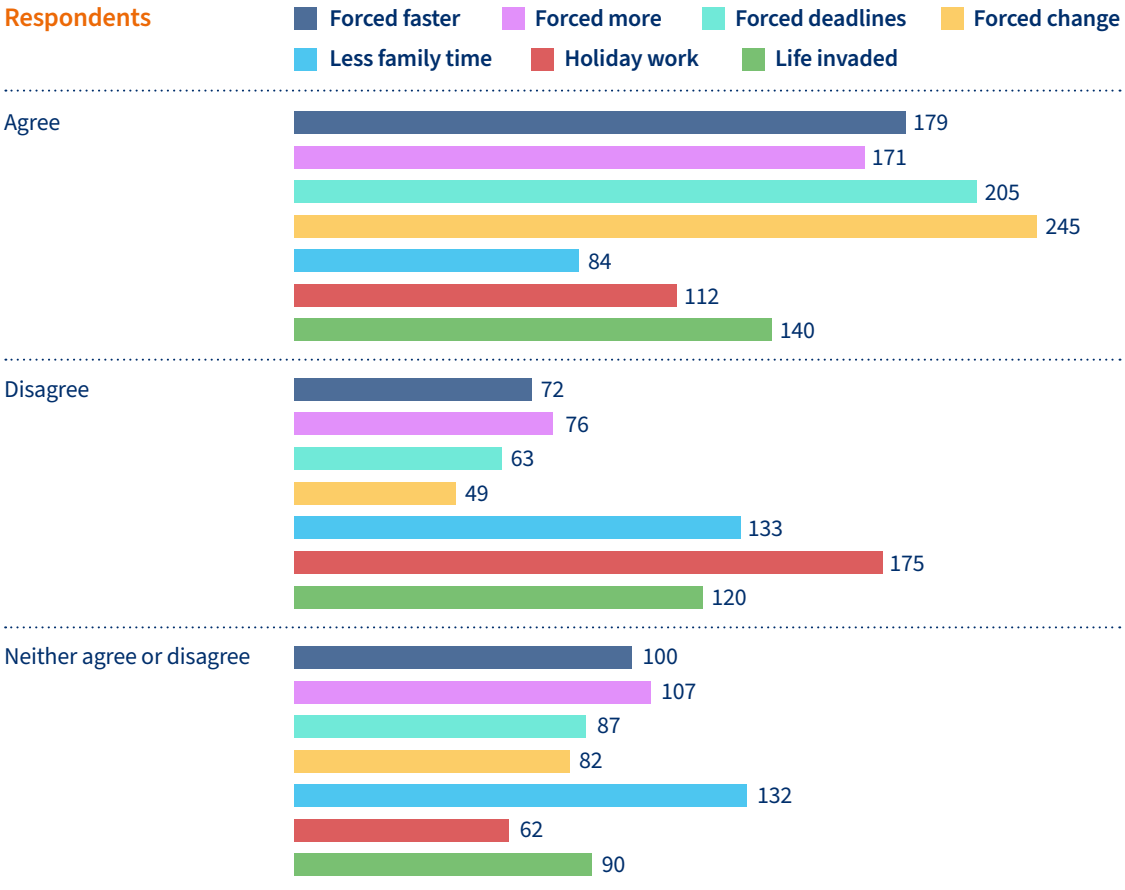
Section 2

Technostress

Figure 3 below shows that most employees believe that AAM has forced them to work faster, to do more than they can handle, to meet tighter deadlines, and to change their working habits. However, they are less likely to say that it has reduced the amount of time they spend with their families, or that it has allowed work to encroach on their holiday time. Slightly more than half of respondents believe their personal life is invaded by work technologies.

Between 29 and 34% of workers say AAM technology has put them under more stress (with regards to speed and amount of work, deadlines, and work habits) and that they consider the work environment to be unsupportive of their concerns. Around 10% of survey participants said technology has not put them under more stress, and that their workplace is supportive. This is suggestive evidence that workers suffer more from technostress in businesses where there is less support (Bondanini, et al, 2020).

Figure 3: Perceptions of technology's contributions to measures of workplace stress



Section 2

AAM in action

This section describes some past and current data capture products to indicate their functionality, scale and scope. Some of the technologies discussed are not necessarily *built* to carry out AAM in the sense of monitoring productivity and performance through workplace behaviour, but - connected to other systems - could have the capability to be used in this way.*

The following use cases for AAM technologies are explored:

1. Collaboration and communications monitoring
2. Digitised task devices with capacity for productivity and location surveillance
3. Specific procedure and practice monitoring
4. Location and asset monitoring and verification in the workplace
5. Surveillance of physiology
6. Video surveillance
7. Lone worker and outside premises monitoring
8. Surveillance of fatigue

Collaboration and communications monitoring

AAM is performed using software to track and analyse email, messaging platforms such as Slack, telephone calls, calendars, and instant chat.

Examples

Humanyze
Pairs digital tracking with a personnel-worn badge which tracks their physical movements to analyse in-person interactions and location hotspots and flow in tandem with the beacons placed throughout the location. The badge can also analyse the wearer's speech through volume and pitch.

Walmart
Filed a patent in 2018 for a system of sound sensors to listen in on worker interactions with customers. The patent dubbed "listening to the front-end" was designed to listen out for bag rustling to determine how large the transaction was, as well as capture conversations and tone of voice to monitor employee performance in customer relations. It is not clear if the technology was finally deployed in stores.

* These are descriptions and examples of tools based on a desk review carried out in 2022/23 and may not be up to date. Please refer to company websites for most up to date description of capabilities.

Section 2

Productivity and location surveillance

Mobile computers and barcode scanners, which can be handheld or hand-worn devices, are used for, among other things, inventory management, team communication and logging of results.

They can have location-tracking functionality as well as time tracking of usage by employees (and thus track productivity). The devices are typically connected to a central management platform for supervisors, managers, and analysts to monitor and optimise work.

Other digitised hardware tools used in the workplace – such as drills, vibration monitors and exoskeletons – could be linked with software to determine how long they are used for (and thus track worker productivity). However, these potential capabilities are not usually promoted by manufacturers and would depend on further software being deployed by companies, and the individual devices being internet enabled.

Examples

Augmented reality (AR)
Headsets can be deployed for remote assistance, augmented training, collaboration and hands-free operation. Whilst these devices are predominantly marketed as next-generation digital interaction tools – more like laptops and smartphones – they can be used for carrying out some aspects of AAM. Companies such as RealWear, Microsoft, Lenovo, Lumus and Atheer are offering AR hardware as well as software in the form of Connected Work Platforms for clients.

Honeywell's Wireless Ring Scanner
Has functionality to give workers verbal prompts towards picking locations in warehouses. Although Honeywell's products were not named, Amazon was fined £27m in January 2024 for 'excessive surveillance' of workers, with the case mentioning functionality of the scanners used by warehouse workers to trigger warnings to them.

Theatro
Offers a hands-free workplace communication platform and headset, which allows employees to request inventory checks, connect directly with colleagues, and make requests such as till back up. It has a location functionality which allows workers to query who is where in the building, such as 'who is closest to the gift wrap department'. The paired 'Manager's App' allows for monitoring performance more broadly.

Section 2

Specific procedure and practice monitoring

Technologies such as RFID tags and eye-movement monitoring can be used to check workplace practices and how specific procedures are undertaken.

Examples

Tobii Pro
Provides an eye-tracking software and hardware solution for clients such as Toyota, Unilever, P&G and ClearChannel, with main use cases listed as safety and risk assessment, enhancing of human performance, and productivity and quality.

CenTrak and SwipeSense
Both have systems that can be deployed in hospitals to aid, for example, hygiene management and assessing staff's time management by monitoring how long nurses spend with patients, or whether they are close to (and assumed as using) soap dispensers to wash their hands.

Location and asset monitoring and verification

RFID (radio-frequency identification) tags are worn on lanyards, carried in pockets, embedded in insoles and can track worker location through buildings. They can also record time in certain locations and proximity to equipment and are sometimes used to authorise equipment operation.

Examples

S3's CheckPoint
This product comprises of static CheckPoint readers placed in locations of note on premises and personnel carried ID tags. This serves the oil, gas, petrochemical and other chemical industries. The data can be accessed, linked to, and processed by proprietary databases.

RFID tags
Can also be implanted into workers' bodies. **BioTeq** offers RFID and NFC implants to employers for opening doors, starting cars and storing medical data.

Section 2

Wellness related physiology

Technologies that collect biometric data can be deployed to enhance wellness programs or aid worker safety.

Examples

Fitbit
The well-known consumer tech fitness tracker also has a large enterprise business serving businesses such as BP, Bank of America, IBM, Target and Time Warner. The devices plug into corporate wellness programs and employers can be provided with dashboards to monitor how employees are performing in terms of sleep, activity and colleague-community fitness challenges. The trackers are sometimes used in collaboration with insurance companies to help calculate health insurance premiums.

Zephyr
Creates body sensing technology comprising of straps, compression and loose-fit shirts and patches with an embedded 'BioModule device' to measure and track body temperature, body positioning and stress levels, among others. It pairs with analytics software and a communications hub for multiple person tracking, and is marketed beyond sports teams and defence clients to first responders in industrial settings such as mining.

Moodbeam
Now depricated, Moodbeam created a wearable device for logging sentiment during the workday. The two-option button (yellow for 'ok', blue for 'not ok') was offered as a way for employees to log and reflect on their emotions by wearing the device on their wrist, clipped to clothing or on a lanyard around their neck. It was connected to the Moodbeam app on their smartphone, and to the employer dashboard for monitoring and analytics. The device also had a sensor to determine whether the device is being carried or not.

ViSafe
Comprises of small sensors which can be attached to various places on the body to track, analyse and report muscle movement. Onsite assessors collect video and motion data from the trackers which then allows businesses to understand unsafe work practices.

Somaxis
Offers a wearable sensor product called Cricket which can measure real-time data from muscles, heart, brain, posture, respiration and movement for 'sensor-based training' for workplace injury recovery. The website claims to have the Cricket technology in use in Microsoft, Yahoo, Facebook, Google, Apple and Monsanto.

Nokia, Kolon & Gina Software
Created a smart jacket that monitored various wearer data points such as heart rate, motion, temperature and location. Predominantly designed for first responders and security personnel, there were also body cams embedded. Data could be connected to the Gina software platform designed for response teams.

Emotiv
Offer a workplace wellness, safety and productivity neurotech solution, which comprises of EEG ear buds worn throughout the day by employees to track their stress and attention levels, analysed using machine learning through a cloud-based enterprise platform.

Amazon
Announced they would be setting worker schedules based on muscle use to decrease repetitive motion and prevent musculoskeletal disorders. They use various wearables, video monitoring set ups and personnel-carried digital equipment to determine muscle use by the employees and which tasks they are repeating to the point of muscle exhaustion.

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Video surveillance

Cameras are perhaps the most obvious form of worker surveillance, with CCTV almost ubiquitous in many workplaces. Cameras are typically used for locating workplace risks and incidents, discouraging bad behaviour from staff and customers, and monitoring employee movements and behaviour (and thus productivity).

Software solutions can be paired with the camera infrastructure to go beyond recorded tapes towards 'intelligent' functionality such as facial recognition, tagging of people and objects, and automated insights and alerts without the need for real-time human monitoring of the video feed.

Example

Amazon's AWS Panorama
Allows companies to have computer-vision capability with their on-premises cameras and claims to improve operations through automating monitoring and visual inspection tasks. Fender Guitars were reportedly cited in the promotional material claiming they use the technology to "track how long it takes for an associate to complete each task in the assembly of the guitar".

Brain activity scanning

Electroencephalograms, or EEGs, are used to monitor brain activity, and corellated with performance and emotion levels.

Examples

Emotiv
Has a range of products that measure workers' brain activity. Emotiv's entry-level model looks like a normal pair of headphones whilst delivering 2-channel EEG signals and indicates that it is able to monitor cognitive load, attention, and cognitive stress levels throughout the day. More sophisticated products have multiple EEG buds touching the scalp to read brain waves in many locations. Using these insights, the claim is that an employee can understand what affects their brain state, - whether that is exercise, holding meetings, or experiences with other people - and what helps them to get back 'into flow' through music, movement, or a change in their environment.

LifeBand by Smart Cap
Attaches into work headwear such as hard hats or company baseball caps, or is worn directly on the head. Connecting via Bluetooth to the Life app, the non-invasive EEG brainwave technology claims to determine worker alertness, displaying a real-time 'speedometer', and allows for progress tracking to support company wellness initiatives. Supervisors can use the LifeDisplay cloud-hosted software platform forcentralised monitoring of workers in real-time and for accessing analytics on shift structures and productivity optimisation.

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Fatigue monitoring

Many companies offer fatigue monitoring technologies, often in the context of deployment as a safety measure to prevent crashes or poor usage of heavy machinery by alerting workers when they are getting drowsy. However most come with a connected cloud-based platform for managers to track workers in real-time and gain analytics on fatigue management initiatives and productivity optimisation. The union for pilots in the UK used fatigue sensors to gather information around their campaign on pilot burnout and fatigue.

Examples

Predictive fatigue management wrist tracker

The Readi platform
Can pair with either the Readi Watch, Fitbit or Garmin devices – claims to allow for predictive fatigue management across industries such as mining, oil & gas, heavy industry and transportation. The technology uses sleep data (from the wearables or from provided schedules) alongside a 'biomathematical model' to provide data on reaction times, mental performance and 'microsleep likelihood'. The model is, according to the website, US Army-developed and is a validated SAFTE algorithm. The Readi platform has three user-bases: leadership & health and safety teams, supervisors, and operators. 'Analytics' for leadership and HSE teams allow for identifying fatigue hotspots, address fatigue on particular shifts or with specific groups, and track impact of fatigue management initiatives. The 'Supervise' access allows supervisors to receive alerts for on-duty works and a dashboard showcasing predicted upcoming risks. For operators, the watch face provides them with fatigue alerts and a daily forecast.

Motion tracking of head and eyelids

Vigo & Optalert
Vigo's Bluetooth headset uses infrared sensors to track eyelid motion via the arm protruding from the ear to the edge of the eye, and an accelerometer on-board to track head motion. It works just like a regular Bluetooth headset with music and phone call functionality, but it also allows the user to be stimulated awake when it senses fatigue via vibrations, sound or light. The user can download an app which showcases their alertness data over time, and offers tips on when to rest. There is the 'For Fleets' option for businesses to adopt the Vigo headset for workers, with a cloud dashboard showing fleet location, real-time drowsiness of drivers, stats on harsh braking, speeding and hard corners and the option to be alerted for 'bad behaviour' such as using a phone while driving. Optalert's 'drowsiness detection glasses' uses a small LED built into the glasses frame to measure eyelid movement 500 times per second. The movement readings are translated into a score which is measured on the 'Johns Drowsiness Scale' and is displayed on a tablet display mounted on the dashboard of the driver's cab. The glasses pair with the company's software platform, Eagle Industrial, and beyond sending the score to the driver's tablet, the scores and system data connect with the 'Fatigue Risk Profiler' – the real-time dashboard for supervisor monitoring.

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Workers' experience of AAM

Having explored the types of AAM technologies that are being deployed in the workplace, this section explores how some workers are experiencing their deployment. These cameos of real-worker experiences, drawn from interviews with workers based in London who have experienced, first-hand the introduction of AAM.[3]

These interviews surfaced a series of issues for workers. Firstly, workers experience little involvement in the introduction of AAM systems, meaning that they either face, or are likely to face, challenges in assessing the efficacy and use of such systems, especially when it comes to their wellbeing. Secondly, there is insufficient training and guidance provided to workers. Thirdly, no impact assessments were carried out. The interviews were semi-structured, and focussed on the arguments that workplaces and workers make around the deployment and use of AAM. All names have been changed to protect the anonymity of the individuals.

Tom

Grocery Delivery Worker

Tom works as a delivery worker for a major UK supermarket. His schedule is very tight, and he is under a lot of pressure to get the groceries to customers in the set timeframe. Oftentimes he is delayed by traffic or by difficulties reaching customers to receive their orders. His employer decides to introduce a system to support safe driving behaviour. It measures his driving behaviour in real-time such as speed and breaks. He receives a score about his driving instantly. He sometimes gets very fixated on the metrics leading him to be unfocused at driving.

Tom indicated that he felt confused because he is often not told about how the system works. His employer purchased the system based on a trial undertaken with a different supermarket and accepts this as sufficient evidence. When Tom and his colleagues enquired about the system, they were told that it worked in the trial and that it should be good for their wellbeing and stress reduction. In order to add incentives, the employer gives those drivers with the best metrics cash gifts. After a few weeks of using it, they realise that it does not work accurately and often produces false reports about their driving.

In addition, the system gives real-time feedback, which stresses out the drivers as it isn't able to see some conditions on the road leading to what the system deems 'unsafe'. It makes a very distracting sound that interferes with many drivers' concentration. Tom's colleagues are particularly frustrated that they have no ability to voice concerns. The health and safety reps also struggle to engage management, which leads to more stress and less safe driving behaviour. They say that they were not consulted in the first place and now they cannot report their faults.

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Diana

Logistics Company Warehouse Operator
Diana is a warehouse operator in a major UK logistics company. She is also the health and safety representative in her division. Over the years, she has seen the company introduce several technologies to mitigate health and safety risks as the nature of her workplace involves a number of potential risks such as accidents due to heavy lifting and working with heavy objects.

Diana becomes increasingly frustrated with the company as she feels the workplace technologies that monitor and mitigate health and safety risks such as workplace sensors and cameras are not harnessed to people's benefit. When near-misses or accidents occur, the technologies that are used to monitor workers and to track product location and transport, are simply switched off after the alarm rings. Diana feels that the technologies serve as a stand-in to signal that her workplace cares about the health, safety, and wellbeing of its workers, but management does not use the technologies to their full potential.

Brianna

HR Wellbeing Lead
Brianna is the HR Wellbeing Lead for a technology firm and is tasked with assessing the benefits and risks of introducing different systems to support the overall health and wellbeing of the company. It is of strategic importance that the company maintains a good reputation for employer wellbeing, so any biometric tracking or other technology she selects must have some good use and positive outcomes for workers. Brianna's main concern is the cybersecurity and safety of the data governance.

Janusz

Construction Worker
Janusz works as a builder in construction. His workplace struggles with high worker turnover due to the heavy nature of the job. What is often invisible in the workplace is the fact that many of his workers, including him, struggle with mental health issues. His workplace offers him and his colleagues to voluntarily use a wearable that prompts workers to record how they are feeling over the course of the day.

Janusz's HR advisor is incredibly supportive of workers who are using these types of apps. HR uses the data collected to jointly assess what the triggers are for a good or a bad working day. With this data, workers are told that HR develops plans and potentially changes job descriptions to better suit workers' mental health. By using the wearable to assess mental health, Janusz feels able to have this difficult conversation with his advisor. Janusz is not aware, however, of what other data the wearable technology might be tracking, such as location. Janusz indicated that he has not been given any information about this, nor about the benefits and risks of using such technologies, in any conversations with managers nor HR.

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Section 3

Algorithmic Affect Management: what is being measured, and how can this data be used?

Use Cases: AAM in practice

Here, we explore what a range of AAM technologies are designed to measure, and analyse the stated purpose for these technologies. We then provide a series of use cases alongside a list of technologies and the purpose to which they are deployed.

Alertness and fatigue monitoring

Alertness and fatigue-monitoring technologies have the potential to significantly reduce the risk of costly mistakes in high-risk industries. For example, in the transport sector (train and bus drivers), or for those working in mining and construction or on military operations, maintaining alertness is critical to preventing accidents and ensuring safety. AAM technologies could help prevent potentially catastrophic incidents and reduce the 135 fatal workplace injuries seen in 2023/24 in the UK.

In addition to physical safety, AAM technologies can also play a critical role in preventing costly mistakes in financial markets. For example, in stock trading, where split-second decisions can have significant financial implications, maintaining alertness is crucial.

Fatigue can be a direct symptom of working in physically and emotionally demanding jobs. AAM technologies can offer a solution to address this issue by alerting workers when signs of fatigue are detected, prompting them to take necessary breaks or rest periods to recharge. However, workers may also fear losses if notifications result in forced halting of work. Fear of job loss is a psychosocial risk which is not sufficiently addressed in the literature.

Alertness and fatigue measuring technologies (and all AAM technologies) may, of course, be inaccurate, or make mistakes, whilst simultaneously creating a false sense of security. This can lead to serious safety risks for workers using them.

For developers, the technology developed may be proven to be less useful than alternative methods like giving autonomy to workers to manage personal wellness. However, there is still a financial opportunity, given they can help companies reduce fatal and expensive mistakes. Developers may gain a sense of pride in working on something that might save lives, by reducing health and safety risks for workers.

Nonetheless, the advantages are clear for both companies and workers, where physically and emotionally tiring work can cause serious issues both for workers' health and for company profits (see Table 1).

Table 1: Summary of opportunities and risks: Alertness and fatigue monitoring via AAM

Alertness and fatigue monitoring	Risks	Opportunities	Potential impacts on Good Work
For workers	• Fear of job loss • Stress and anxiety	• Reduced chance of injury including fatal or permanent injury • Higher levels of understanding / self-knowledge	• Dignity • Wellbeing • Equality • Privacy • Autonomy • Access to work **See our Good Work Charter for further information**
For employers	• Inaccurate measure • False sense of security • Risk of non compliance?	• Reduces the risk of expensive mistakes, including financial loss and reduced insurance costs • Opportunity to improve work quality	
For developers	• Technology developed may be proven to be less useful than alternative methods like giving autonomy to workers to manage personal wellness	• Reducing expensive and fatal mistakes is a large market • Meaningful to work on	

People analytics and performance management

Well-implemented people analytics for performance management may have a positive impact on businesses, with claims of major benefits reported by consultancy firms like McKinsey. These improvements can come from celebrating top performers and supporting or removing low performers, but they can also come from making genuine, data-driven improvements in the workplace environment. For example, AAM helped one company understand the links between employees' social behaviours at work, and their productivity – leading the company to invest in workplace furniture that encouraged these behaviours.

AAM technologies can also help employees understand their own behaviours. Tracking emotional states could theoretically help an employee see which projects, people, and experiences trigger different emotions, and how different dimensions of work and interaction impact their happiness and productivity.

A foreseeable benefit is that using AAM could enable a worker to avoid higher-risk tasks when their alertness is low.

However, research from IFOW shows how increased workplace surveillance interacts negatively with workers' subjective wellbeing (Soffia et al., 2024). Companies should thus be aware of the key difference between offering emotional awareness for workers and conducting surveillance of them.

Our research points to the risk that AAM may reduce the scope and scale of creativity that is available for workers, leading to feelings of reduced autonomy. Data from monitoring and tracking workers is often not correlated to value for a company, either. Emotional awareness and sensitivity toward workers' emotions can, however, empower people, as is argued in one McKinsey analysis of people analytics (Hancock and Weddle, 2024). However, using such data for more reasons than being emotionally sensitive toward workers, on top of being difficult to justify against data and privacy law, could, at worst, distract managers

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from focusing on ways to foster productive and healthy working environments. Whilst already top-performing organisations are more likely to have better results from any technology introduced, due to having larger research and development teams and capital to invest in the more expensive products, average or lower-performing companies may not be able to enjoy the same gains with AAM approaches.

A significant risk in the deployment of AAM technologies is that of mission creep, with more and more data being collected simply because the opportunity to do so exists, rather than there being an operational necessity to do so. There is a significant risk of companies not being transparent about what data is collected, why it is being collected and for what purposes, and the extent to which it could be shared with other parties. As employment can – in certain contexts – be viewed as an asymmetric power relationship, with significant information asymmetries between employer and employee, the collection of data that further tips the balance of this relationship needs to be handled with particular sensitivity (see Table 2).

Table 2: Summary of opportunities and risks: Performance management via AAM

Performance management	Risks	Opportunities	Potential impacts on Good Work
Employees	• High performance workers with a unique way of working can receive poor reports unfairly • Unsupported workers with poor managers may be let go for poor emotional performance • Training data reflects past patterns and bias, reinforcing inequalities in the workplace • Misrecognition and associated risks of bias • Reduced investment in human contact and human relations	• Good performance becomes more visible • Understanding and awareness. It becomes easier to identify strengths and perform better at work	• Learning • Autonomy • Support • Participation • Equality • Fair pay • Fair conditions • Access **See our Good Work Charter for further information**
Employers	• Talent retention under conditions of high surveillance • Emotion-based reports are not the whole story (or accurate), reducing employer understanding • Data-driven research can distract from the human side of coaching great managers	• Opportunity to learn and support others to learn too • Potential for significant increases in workplace productivity[4] • Opportunity to improve pay, conditions and quality of work	
Developers	• Negative sentiment regarding workplace monitoring makes it hard to hire talent and market new technologies • Research may reveal there are easier ways of achieving the same insights	• New organisational design research can be turned into features and sold to employers • Evidence for new workplace design principles can be uncovered	

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Section 4

Conclusions: Provocations for policy and research

Summary of Findings

Taken together, our analyses point to a **new frontier in the development and use of inferential biometrics-based systems at work**, including neurotechnology. This frontier marks a shift in the scope, manner and basis for managerial decision-making, as wide-ranging, automated inferences, classifications and measurements relating to **who a person is or how a person is likely to behave at work** – as well as how work is performed – is become increasingly more significant. We have called this 'Algorithmic Affect Management' (AAM).

AAM has **multi-faceted regulatory challenges** and invites careful review of the scope, applications and enforceability of existing protection under **employment, data, AI, equality, health and safety and IP domains**.

Our research and analyses show that – in spite of the potential for agreed and transparent use to improve work design and experience, conditions and quality – **some uses of AAM are linked to exploitative practices, especially those which can drive technostress**. Reliance on sophisticated, intrusive inferences and actions made by 'automated' AAM systems derived from AAM data is driving new forms of harm and risk to human, health and labour rights. New forms of surveillance – including 'neurosurveillance' – are also **acting as a gateway to other detriments**, such as AAM monitoring of cognitive and behavioural functions, with inferences used **to predict and measure performance, hire and fire, or determine pay, benefits or work allocation**.

The current patchwork of protections is not sufficient to clearly safeguard and promote privacy, physiological or mental integrity and other fundamental rights when AAM are deployed at work. These are also inadequate to prevent new and emerging harms or mitigate potentially significant risks, which are likely to further increase as AAMs are developed. These risks are being further complicated as AAM data is used to train Large Language Models (LLMs) and these foundational technologies are used to interpret, process and simulate human affects in workplaces, and may in turn be integrated into AAM systems.

There are different models to protect against unfair and harmful use of AAM at work, from red-line prohibitions to purpose limitation. These can be combined, boosted and aligned with a multi-layers approach encompassing
1) enhanced transparency and consultation
2) monitoring/oversight provisions
3) limitations on purpose, function and use/ implementation (including system switch-off).

To ensure use is **fair, verifiable and necessary** use could be tied to workers' essential job functions or a requirement to demonstrate that the AAM promoted the vital interests of the worker and his or her 'wellbeing'.

Our research shows that meaningful and informed consent is not workable and should not be relied on as a proper basis for AAM in the context of work. This should not prevent individuals from choosing to use affective computing tools to enhance self-understanding and self-direction privately.

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At a firm level, our analysis invites a **shift towards pre-emptive and collective governance of AAM**, over-reliance on individuals proving a breach of isolated rights. Because of the way in which AAMs work to find common patterns and classify subjects by group, regulation should cover individual and relational or collective risks and impacts. This is most obviously seen in relation to direct or indirect discrimination based on protected characteristics or other unfair bases, such as accent, socio-economic background or neurology. In any event, stereotypical or inaccurate assumptions and ascribed emotions which form the basis of AAM classifications may be compounded.

At a higher level, research, development and incentives to adopt AAM technologies should be directed towards **purposeful design, development and deployment of AAM aimed at improving work**, including work terms, conditions and quality. This reflects international regulatory directions that draw out the importance of rights-based design, verifiable use and ongoing monitoring to make sure that AAM promotes wellbeing and human flourishing. This approach highlights the need and benefits of building a culture of trust and effective partnership working between industry and unions across the AAM life cycle.

The current patchwork of protections is not sufficient to clearly safeguard and promote privacy, physiological or mental integrity and other fundamental rights when AAM are deployed at work.

Specifically, evidence of the 'new frontier' involving particularly intrusive and high-risk forms of monitoring and AAM invite the development of some dedicated, freestanding protection against **'neurosurveillance' and the use of AAM data to manipulate, interfere or commodify workers' cognitive, emotional or behavioural functions and capabilities**. Although grounded in established legal and ethical principles, these rights could be framed as 'neuro-rights' aimed at preventing unfair and excessive 'neurosurveillance' and associated automated decision-making in the constrained environment of work. They would help distinguish between work and private life more sharply, offer a more accessible remedy for any significant detriment arising from AAM - whatever form it takes – and regulate the 'new frontier' which is the subject of this report.

Such interventions could be seen as part of the UK government's review and **extension of employment protection from surveillance and the right to disconnect**. These would be additional rights and must not be considered a substitute for clarifying the broader and domain-specific limitations in the GPDR, Equality or Health and Safety Acts, much of which can take place in secondary legislation, codes and guidance.

Overall, our research shows that a clearer, more **robust, integrated and reciprocal 'systems'** approach is needed to address the challenges and maximise the opportunities from AAM in the workplace. This broadly supports a move towards **responsibility by design** reflected in the development of **affirmative 'safety' duties**, shifting regulatory emphasis towards proactively advancing established principles of safety and accountability, as AAM are engineered, developed and deployed for use at work. This is consistent with international directions, including the UNESCO Recommendation on the Ethics of Neurotechnology in September 2024. Here, neurotechnology is an instructive case study to test the application of existing regulation and ensure new protection is future-proofed.

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These moves could be supported by due diligence and monitoring provisions requiring a process to enable **responsible actors to anticipate, mitigate, monitor and respond to known and new impacts** in the workplace and embed this across supply and value chains. This could be enabled by transparency and disclosure provisions, built around significant risks and impacts in workplaces – boosting the capacity and knowledge of working people, their representatives and SME 'end-users' so that new and more effective forms of collaboration and partnership working can take place.

In this way, our research and analyses invite a **new focus and thresholds to shape transparency, evaluation and good governance of AAM at work: risk and impact monitoring of changes to work, conditions and quality – especially health and wellbeing, equality and risk to human and other workplace rights**.

Prior 'safety' testing, risk and impact assessments and a process for ongoing monitoring and reasonable adjustments being made is required for those developing or intending to use AAM tools or data.

Provocations for Policy and Research

Although a full legal review is outside the scope of this report, our analyses point to the following specific conclusions and interventions, which should be subject to public consultation:

- **There is a need for sharper definitions, thresholds and regulatory guidance** across legal domains to extend the application of existing protection to AAM, starting with clarifying the definition of 'safety' and 'wellbeing' in occupational health protection, and guidance which explicitly addresses psychosocial harms.

- **Data protection at work should be clarified and extended to clearly cover AAM** use and impacts. This invites the extension of protection beyond individual, identifiable data subjects, and for impact assessments to cover significant effects on work or workers and tightened purpose limitation – which are more important than understanding the internal logic of AAM systems. In the new Data Bill additional protection against automated decision-making should be reviewed, boosted, and explicitly extended to inferences and use of AAM at work.

- **Employment protection from surveillance and fire and re-hire should be extended** to cover intrusive development and deployment of AAM. AAM for purposes other than limited, disclosed and verifiable bases should not take place, alongside a strict prohibition on psychological manipulation. Meaningful 'opt-outs' provisions and protection against workplace AAM detriment should be introduced. Any performance targets, measurements or outcomes arising from the use of AAM at work should be disclosed and open to challenge. We also invite consultation on the development of dedicated 'neuro-rights' to more tightly limit the use of AAM data to assess, infer or predict workers' behavioural

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and cognitive functions, performance and capacities; and to explicitly prevent manipulation or interference with these functions or commodification of AAM data. We think that such interference or manipulation by AAM at work should be prohibited.

→ **Prior 'safety' testing, risk and impact assessments, a process for ongoing monitoring,** and reasonable adjustments being made are required for those developing or intending to use AAM tools or data. Such mechanisms for rigorous evaluation and response should be built in across legal domains. To be effective, these should identify and involve affected stakeholders and cover significant effects on work and workers, including access, terms and conditions, health and equality, and apply across the AAM life cycle.

→ **Boosted rights of individual and collective access and disclosure of information** which is relevant to establishing risks and impacts on work and workers and consultation of individuals and their representatives will be needed to track and respond to AAM at work and ensure compliance, as well as the best outcomes. Transparency obligations should extend to information about third-party contracts, data-sharing and any proposed re-purposing of AAM data. This will also help deliver and future-proof the proposed 'hire and fire' and workplace surveillance protection.

→ **Equality law should be extended to cover the new unfair bases and intersections** surfaced through our research of AAM. These may not be captured by existing protected characteristics and should include direct or inferred socio-economic, place-based and neurological bases of classification.

AAM for the purpose of inferring protected characteristics, trade union membership, and likely use of rights should be explicitly prohibited. Whistleblowing protection should cover AAM use outside defined limitations and creep.

→ **Regulators' (such as DRCF, the AISI and the Fair Work Agency) capacity** to develop guidance, interrogate AAM use at work, initiate test cases and work with each other and civil society should be increased. This is a priority where secondary legislation, regulator codes and guidance and cross-domain collaboration are being relied upon.

Boosted capacity should be extended to cope with expanding AAM use at work and cover regulator recommendations, such as the ICO maintaining a register of AAM use.

→ **Programmes to promote AAM literacy for workers, unions and managers** should be developed and incorporated into AI literacy work.

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Future directions

There is a need for further normative, multi-disciplinary and legal research into AAM and the development of regulation at an international level. The EU's AI Act emphasises that systems 'intended to be used to detect the emotional state of individuals in situations related to the workplace and education should be prohibited'.[5] However, the UK is well placed to draw on strengths in research, regulation and innovation as it develops new laws through forthcoming Bills on employment, data and AI. Here, the government may be able to model, 'sandbox' and develop models of gold standard regulation to promote responsible and accountable use of AAM at work.

The consultation periods in these bills, establishment of the remit and functions of AISI, the Fair Work Agency, Skills England and postponement of the national Procurement Guidance in anticipation of a new National Procurement Policy Statement, will allow the UK time for wider stakeholder engagement and consideration of the latest research and relevant international developments as the new regulation is developed and aligned by the mission-driven government.

We note that international regulation can still be shaped, including the new draft UNESCO Recommendation on the Ethics of Neurotechnology in September 2024 (with a view to adoption in November 2025) that emphasises the need for evidence-based, verified approaches aimed at promoting human dignity and wellbeing[6]. Also open to shaping is application of the EU's Corporate Sustainability Due Diligence Directive (CSDDD) which requires large companies to assess and monitor impacts on human rights, including work conditions across supply chains and subsidiaries, for example by making adjustments, other investments or seeking contractual assurances.[7]

Leadership in AAM regulation would re-establish the UK as a global leader in responsible AI, benefiting from the first-mover advantage and avoiding the Brussels effect. Our research suggests that this would not only benefit individuals and groups, but also firms through the mediums of trust, perception and improved wellbeing at work.

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>
> **Anna Thomas MBE**

Endnotes

1 Technostress is 'commonly defined as a modern disease of adaptation caused by an inability to cope with new computer technologies, affecting mental health in a manner which may manifest as a struggle to accept computer technology, or as over-identification with computer technology. It is also defined more generally as any negative impact on attitudes, thoughts, behaviours, or body physiology that is caused either directly or indirectly by technology. Research on technostress tends to focus on business users of technology, and particularly the mandatory use of technology'. Bondanini, et al, 2020.

2 Wilcoxon test p-values all far below 0.01 for each test, with samples of 369, 365, 364, 366. 365 respectively, based on the number of respondents to each question.

3 Interviews carried out by Dr Gwen Barnard in 2023 with business leaders who have experienced the introduction of AAM-orientated technologies.

4 Humanyze increased workplace performance by 11%: https://www.washingtonpost.com/news/business/wp/2016/09/07/this-employee-badge-knows-not-only-where-you-are-but-whether-you-are-talking-to-your-co-workers/

5 Recital 44 of the EU AI Act: https://artificialintelligenceact.eu/recital/44/

6 UNESCO – https://unesdoc.unesco.org/ark:/48223/pf0000391444, "IV.14.LABOUR AND EMPLOYMENT" (Points 140–148), sets out the type of workplace policies and incentives that Member States should establish e.g.:
- "*any deployment of neurotechnology is evidence-based, with a focus on applications that have been scientifically validated to promote employee well-being, such as reducing stress or enhancing workplace conditions*"; and
- "*deployment must be on a voluntary basis and employees must have the option to opt out of using neurotechnology without facing any negative consequences or discrimination*".
- Refer to the link for more specific employment protections.

7 The CSDDD requires to take "appropriate measures" that are capable of achieving the objectives of due diligence – e.g.:
- Developing and implementing prevention action plans
- Seeking contractual assurances from business partners and measures to verify compliance
- Making necessary financial or non-financial investments
- Adjustments/upgrades into operational processes and infrastructures
- Modifying business plan.

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We advocate a world of work where everyone can benefit from new technology and innovation, not just employers and technology companies.

Mary Towers
AI Working Group Lead, Trade Union Congress

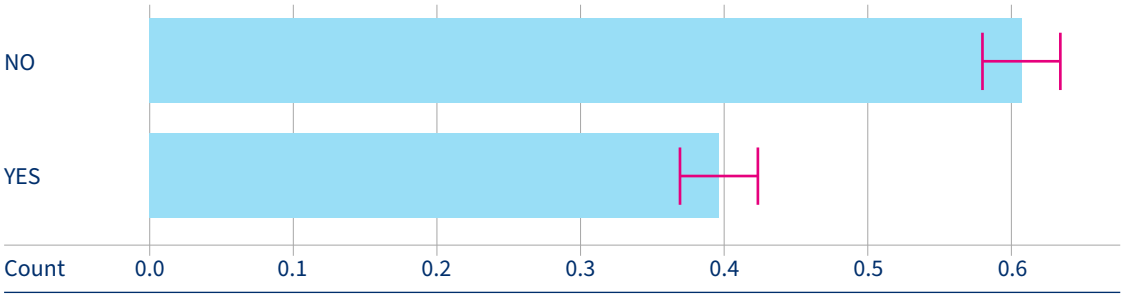
Appendix

Surveys

Of the 380 respondents, 26 either did not report, or did not express that they know whether, their employer has introduced monitoring technologies at work.

Tech at work	Number of respondents
1. Don't know	5
2. No	214
3. Yes	140
4. NA	21

Figure 1: Has your employer introduced any technology which collects information about your health, safety or wellbeing at work?



Appendix

This section provides a list of technologies that track biometrics, physiology, emotions and therefore, affective labour.

Name of AAM	About	Year introduced	Designed to measure
Distance Assistant	Introduced by Amazon, but available to any organisation for implementation in their own workplace. AI-powered **software** which links up with on-premises cameras, depth sensors and screens to display in real-time visual feedback (green circles for 6 feet and beyond, red circles for those too close) about where workers are standing in relation to one another.	2020	Health
AiRISTA Flow	Created personnel-carried hardware 'tags' which communicate with a software platform using existing business wireless infrastructure, employee smartphones or gateways provided by AiRISTA Flow if need be. The tags make a sound when they come into close contact with one another, and employees can wear them on their wrist, as a pendant or as a key fob. Not only do they alert in real-time, all the contacts are recorded on a centrally managed and accessed cloud-based software platform. The company usually creates business technologies for asset tracking, condition monitoring and process management.	2020	Health
Honeywell	A multinational conglomerate which has operations in the business of company asset and inventory management through tracking, scanning and check-in technology. Their Operational Intelligence asset management platform was enhanced to include social distancing proximity detection (making use of their mobile devices such as wearable computers and barcode scanners), device chain of custody monitoring (for shift changeovers to track handling of mobile devices), and building occupancy counting (by tracking mobile devices of workers and customers).		
Nymi	Connected workforce platform with the Nymi Band – a wrist-worn wearable with wireless communication functionality as well as on-device biometrics for identifying the wearer and integrated sensors collecting individual and environmental data. Covid-19 social distancing and contact tracing functionality was added to the platform.		
Radiant	Company focused on enterprise IOT solutions for asset tracking, created a social distancing product which runs on Samsung smartwatches for contact tracking and automated social distancing alerts. Built on the Virtual Asset Tracker framework they already offer for asset tracking, and paired with their cloud-based processing platform in the background. Bloomberg reported a current contract with Ford, and OneZero were told that the smartwatch biosensing capabilities are turned off for workers by default.		

Continued

Appendix

Name of AAM	About	Year introduced	Designed to measure
Reactec	The company launched their SAFE-DISTANCE wearable proximity alarm watch, which is an enhanced version of their HAVWEAR monitor built for assessing and managing hand arm vibration, again with a cloud-based data management platform behind it. They also have their RASOR device, which is placed in a fixed location or carried by a supervisor, which gathers all the data from multiple HAVWEAR devices within a 40m range.		
Redpoint	Another company already in the business of location tracking of business assets using tags, which adapted their technology for social distancing enforcement and monitoring. Their 'Internet of Moving Things' platform connects up all the data on locations of equipment, people and assets in warehouses and other industrial facilities, and the Covid-19 monitoring was added as an application to the platform for companies to adopt and use with the existing tag hardware.		
Zebra	Largest RFID and asset-tracking company globally, released their 'MotionWorks Proximity Solution' which connected to their mobile computers workers use in industrial applications already, or with their Bluetooth low energy devices again already on the market and in-use with their clients for location tracking of assets.		
DERMALOG	Biometrics company specialising in all sorts of biometric identification technologies, now experiencing demand specifically for pandemic management systems such as facial recognition terminals (to save fingerprint touching of surfaces) and temperature sensing technology through their 'fever cam'.		Temperature and identity checks
Infrared Cameras Inc	Infrared technology manufacturer for various industries, now promoting their 'Slow the Spread with infrared' devices, including cameras, handheld devices and check in stations for temperature checks. Features include centralised monitoring, access control, notifications and alerts, and facial recognition.		Temperature and identity checks
Telpo	Company focusing on 'smart retail' solutions such as point-of-sale devices, self-service terminals and ticket validators. Capabilities include facial recognition, temperature checking cameras, digital vaccine passport solutions and biometric mobile screening – all bundled up into their 'Face Recognition Temperature Management Terminal'.		Temperature and identity checks
Empatica	A medical device manufacturer predominantly with clients in the clinical research space offers 'Aura', a wearable AI system for early detection of respiratory infections which makes use of their existing E4 or EmbracePlus medical devices. The smartwatch comes with an app and online dashboard for individual and supervisor feedback and alerts.		Covid-19 infection detection and monitoring

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