

AI-BASED SYSTEMS AND ADVANCED ROBOTICS

European workshop (September 2021)

Introduction

AI-based systems and advanced robotics are becoming increasingly prevalent in our workplaces. Intelligent systems are taking over a wide range of not just manual but also cognitive tasks. As technology enters the work environment, new challenges and opportunities for occupational safety and health (OSH) arise. Collaborative robots, so-called cobots, can collaborate with their human workers in a shared workspace. With the increasing use of artificial intelligence (AI), automated systems are now able to carry out more complex tasks. Continuously, AI-based systems are expanding their use in many different sectors and settings.

Historically, automation has made it possible to remove workers from hazardous situations and to improve the quality of work by handling repetitive tasks. However, the automation of tasks may also create OSH risks and challenges, as it changes the content and design of jobs.

The online workshop on 'Advanced robotics and AI-based systems for automation of tasks – Perspectives on occupational safety and health (OSH)', is one of the first of four projects under the digitalisation operational activity of the European Agency for Safety and Health at Work (EU-OSHA). This seminar summary presents the results of the project so far.

The workshop took place in the form of a webinar on 14 September 2021 from 10 am to 3 pm. In addition to the introduction by EU-OSHA, three key speakers presented relevant developments in the field of AI and advanced robotics. Two breakout sessions were also offered to the 44 registered participants: one on the assessment of the OSH challenges and opportunities associated with AI-based systems for the automation of cognitive tasks, and the other on the OSH challenges and opportunities associated with the state of knowledge on advanced robotics. Each breakout room included a discussion section, and the main discussion points and conclusions were consequently presented in the final plenum of the workshop.

Speakers

Moderation

- Ioannis Anyfantis (Moderator) EU-OSHA

Speakers

- Jesús Francisco Alvarez Hidalgo European Commission
- Matthias Fritz European Commission
- Sascha Wischniewski Federal Institute for Occupational Safety and Health (BAuA), Germany
- Patricia Rosen, Eva Heinold Federal Institute for Occupational Safety and Health (BAuA), Germany
- Robert Donoghue University of Leicester (UL), UK

Presentations topics

Presentation 1: *Digitalisation and AI in the new EU-OSH strategic framework 2021-2027*
Jesús Francisco Alvarez Hidalgo, European Commission

Presentation 2: *The new EU initiative on AI regulation*
Matthias Fritz, European Commission

Presentation 3: *Setting the scene: Definitions, mapping of uses and overview of policies, strategies and programmes in relation to AI-based systems for the automation of tasks and OSH*
Dr Sascha Wischniewski/ Patricia Rosen, Federal Institute for Occupational Safety and Health (BAuA), Germany

Breakout room 1

Presentation title: *Assessment of the OSH challenges and opportunities associated with AI-based systems for the automation of cognitive tasks*
Dr Sascha Wischniewski (BAuA)
Robert Donoghue, University of Leicester (UL)

The presentation focused on OSH challenges and opportunities associated with AI-based systems. It contained examples of person-related AI supported tasks: teaching, care work, customer support; information-related AI supported tasks: code generation, data processing, decision-making; and object-related AI supported tasks: self-driving vehicles.

A central point of this breakout room was the risks that arise with AI integration into the workplace. This included job loss, which has a strong link between job insecurity and poor mental health outcomes, job transformation and its dual role of being both the problem and the solution, present psychosocial OSH risks, loss of privacy and its relationship to unknown data forfeiture, General Data Protection Regulation (GDPR) violations, risk exposure and job insecurity, anxiety, loss of autonomy, depersonalization and arbitrary managerial prerogative.

Breakout room 2

Presentation title: *Assessment of the OSH challenges and opportunities associated with the state of knowledge on advanced robotics*
Patricia Rosen/ Eva Heinold (BAuA)
Elena Fries-Tersch (Milieu)

The presentation introduced the types of applications for advanced robotic systems based on the taxonomy presented in the plenary session. This included object-related tasks for advanced robotic systems such as wall construction, pick and place, object holding; and person-related tasks such as eating assistance, patient lifting, etc. Social robots find more application in cognitive tasks, although real collaborative scenarios are rare. A list of most frequently influenced OSH aspects were presented including: mental/cognitive workload, wellbeing, ease of use, user satisfaction, trust (a key variable influencing psychosocial and physical OSH aspects), physical workload, and accidents (mediated). A highlighted result was that, for advanced robotics, special attention has to be paid to interaction design (anthropomorphic versus functional design, as well as dialogue principles and transparency), and task design (human job control).

Discussion

A vital part of the workshop was the discussion of OSH relevant topics regarding AI-based systems and advanced robotics among the speakers and participants. There were four central opportunities to do so, starting with a more general Q&A session after the initial presentations. Then, each of the two breakout sessions also had a dedicated timeslot for discussion, and finally there was a roundtable discussion with all participants. The summaries of these are presented in the sections below, and Appendix B also contains an extended write-up of the discussions.

Q&A Summary

Following Sascha Wischniewski's presentation, a Q&A session was held, where participants could pose their questions regarding various topics and express new viewpoints informed by their respective expertise and experience.

Topics addressed in this Q&A were current discourse around defining AI-based systems, how current legislation addresses OSH in this field, as well as how AI-based systems can be defined and which technologies can or should be included in future discussions. For a complete write-up of the Q&A section, please refer to Appendix C.

Discussion of breakout room 1

The discussion in breakout room 1 centred on OSH challenges and opportunities associated with the current development regarding artificial intelligence in the workplace for the automation of cognitive tasks. A major concern expressed by the participants was the loss of privacy/autonomy/transparency. Possible suggested ways to deal with this risk were guidelines or legislation to protect workers and to involve the developers of these systems early on in these discussions. Another focus lay in strategies for general risk mitigation through design and improved technology in the future. Participants agreed that, in the workplace, there should be mechanisms of resistance, negotiations and controls on things like data collection. To enforce that, structural regulations in the labour market might be needed.

Discussion of breakout room 2

The discussion in breakout room 2 centred on the OSH challenges and opportunities associated with the current development regarding advanced robotics. The main points of discussion were collaborative applications, robotic design and behaviour, and the organisational perspective.

Regarding collaborative applications, participants discussed the gap between expected and actual applications. According to the participants, this form of work is not frequently found as return on investment (ROI) is often not given, especially in manufacturing.

As for robotic design principles and behaviour, participants highlighted transparency and system capabilities as important, expressing an interest that these aspects are indicated directly by the system or its physical appearance (eyes = able to process visual cues). Regarding AI strategies, system transparency was also highlighted. Another major request was clear accountability when it comes to AI-based systems and decision-making. Participants further acknowledged attribution effects in advanced robotics and related responsibility effects as important to consider.

From an organisational perspective, participants agreed that a holistic view of working systems and OSH is necessary. Possibly in the form of a lifecycle perspective. The model of robot-as-a-service (RaaS) and OSH effects was mentioned.

A final conclusion was that automation processes have to be task-based and analytic, especial if the process is more flexible and dynamic (intelligent process automation).

Roundtable discussion

During the final round table discussion, all participants had the opportunity to enter questions and pointers for consideration towards both the present experts as well as other participants. The concern on how to deal with technological development outpacing legislation in its development was brought up. While there are guidelines present for human-centred design, the importance of legislation staying as up to date as possible was highlighted.

The possible role of manufacturers and/or software programmers regarding accountability was also discussed. Examples of legislation addressing this topic, especially for technology that is seen as high risk, were named. Furthermore, possible time frames for legislation to be developed and implemented were discussed.

Finally, participants concluded that for AI-based systems to be a successful and safe part of the work environment, the implementation process is key.

A summary of the workshops central points for the upcoming project was presented:

- Recommendations from ETUI/OECD are at a very high level – future recommendations should go into more detail;
- It is important to include in the reports that we have to talk to the software developer, but also to address people who implement the technology;
- Possibility of delegated acts might be a solution to keep up with rapid developments, although it's a tough race;
- Where to implement these systems first is where people are at high risk from a physical point of view, but also from a cognitive point of view.

For a complete write-up of the workshop's discussions, please see Appendix B.

Appendix

List of participants

Adascalitei, Dragos
Alvarez Hidalgo, Jesús Francisco
Anyfantis, Ioannis
Baiocco, Sara
Blaise, Jean-Christophe
Bretschneider-Hagemes, Michael
Brun, Emmanuelle
Cayuela, Ana
Cefaliello, Aude
Chatila, Raja
Costelloe, Alan
Curtarelli, Maurizio
Donoghue, Robert
Draicchio, Francesco
Earthy, Jonathan
Fries-Tersch, Elena
Fritz, Matthias
van Gulijk, Coen
Furlani, Patrice
Heinold, Eva
Inkilä, Teija
Ispasoiu, Adrian
Kim, Wansoo
Komel, Vladka
Konstantakopoulos, Ioannis
Ljung, Robert
Malisa, Viktorijo
Nickel, Peter
Novohradská, Jana
Panicker, Suresh
Peifer, Yannick
Reinhold, Karin
Rosen, Patricia Helen
Sandini, Giulio
Šidagytė, Rasa
Starren, Annick
Steiner, Martin
Steimers, André
Telo, Emília
Umbreit, Matthias
Vala, Jiří
Villamil, Amanda
Weber, Tina
Wischniewski, Sascha

The experts' perspective: Workshop discussions between the experts

Q&A after presentation 3:

Q: On working definition and definition used by DG CONNECT AI Act and this project by EU-OSHA: deterministic systems versus AI-based systems. Why the discrepancy?

A: Emerging technologies are not everywhere yet, so our scope is broader for this study at EU-OSHA. We also include cobots as advanced robotics (not only AI-based systems which have adaptive features) as there is no OSH yet.

A: Annex 1 in the AI Regulation [reading out the definition in Annex 1] includes a wide range of things, and possibly also deterministic systems.

Q: 1. Would autonomous driving vehicles qualify? 2. More focus on psychological pressure; 3. interesting data in European manufacturing survey – only 2% of SMEs currently have artificial intelligence applications in use; 4. Extremely important to also take into account security aspects (e.g. hacking).

A: Autonomous vehicles are included, but limited and not in detail, as there are multiple categories. Security is also considered, as it is a major threat for safety (will be covered further in breakout sessions).

Q&A breakout room 1:

Q: Regarding the loss of privacy/autonomy, what is the best way to mitigate risks? Workplace discussion? Give the choice to workers?

A: There are health/safety representatives, and scientists covering this topic widely (e.g. autonomous cars). The difficulty is knowing in advance what will happen, so a responsive side (union) is needed.

A: Both. There needs to be more specific guidelines given to manufacturers/software developers on what is important (what human factors? how do you code autonomy in assembly/knowledge work?). This is important in implementation (support algorithm so that it does not get biased).

Q: How to mitigate risks? Structure of hierarchal controls on organisational level (people and technology)? How to (re)design/improve technologies in the future?

A: Technological development likely cannot be controlled. But still, in the workplace there should be mechanisms of resistance, negotiations and controls (what data can be collected, what disciplinary actions, etc.). For instance, delivery workers have strict rules, but the employers cannot discipline the workers using the data. Structural regulations are needed in labour market.

Q&A breakout room 2:

Q: 1. Manufacturing sector: one of the reasons why collaborative robots are not found a lot is that when you use them, you have to reduce the speed. Therefore, mostly it is better for productivity to fence robots, because the speed can be kept. Many companies face difficulties in having return of investment here. Especially, replacing the worker does not pay off; 2. The anthropomorphic design is less important than in health sector; 3. Study on AI: one of the key findings: when AI as a co-worker, the acceptance is much higher – people would like to be asked, e.g. if the system/AI asks the human worker to help him/support him, it increases acceptance.

A: 1. If we are looking at the current scenarios, we almost do not see any collaborative scenarios, because the return on investment is not given. Also, there are not that many tasks where such a collaboration would be that sensible. Not so many tasks where two humans work closely together on a task either. 2. Yes, anthropomorphic design plays a lesser role in manufacturing. However, if a system has anthropomorphic features, you need to make sure that these features go in line with the task (especially in the manufacturing sector, otherwise people will get irritated). 3. Study: participation and transparency are very important factors which should be considered for AI and robotic systems likewise.

Q: [1.] Are data from the implementation of the robotic process automation included in the context that it's a software but not physical? 2. Bridging legislation and real work: function allocation – what are the

attributes and the allocation priorities based on which the private actors assign the action to be carried out by a robot or a human? Where is the function allocation reflected in the draft AI Act, what is your view? The prioritisation is very one-dimensional: number of FTEs that can be saved? It all came down to reduce the costs? What can be done to ensure that in reality we don't just go down to the reduction of costs, and caring about OSH does not become an empty cover?

A: [1.] Did include robotic process automation when it came up – not that many studies which look at the whole process, rather lab settings or pilot areas. 2. Function allocation: something that's driven by what's profitable and what are the capabilities of both parties – there are a lot of companies which say that they want to use a robotic system, but if you have a task in mind probably there is not a robot that can do it; but if one looks 'ok, what can the robot do?' and then leaves the rest for the human, there's the risk of not designing tasks based on the needs of the human. This is addressed in the Annex of the Machinery Directive in the ergonomics part. Touched on the processes and function allocation; map current workflow as it is done manually, then look how and what the robot can do, and then design it that way. However, this is the more expensive way; normally, you just take the workflow and then adapt the robot to take over the whole task done by the human. This is why most research and bibliography were talking about the automation of tasks; robots may be good in automating some tasks, but they cannot perform an entire job.

Roundtable discussion – main points:

- Technology moves faster than we can legislate. Trade unions' power is diminishing due to new roles. We keep talking about 'data protection' – aren't we too late with that? I think it should be about data *management* because big companies are profiting from our data. We need to change the culture, which starts with early childhood education.
- Distinction between cognitive and physical tasks: there's a rationale that makes sense. However, we need to think about this in a different way; dimension of digitalization – when we say that robots can take over physical tasks; on the other hand, we are talking about control processes – these have logic inside, and they are all rather cognitive processes rather than physical. Hierarchy of controls – there's always both involved. When we talk about it in a way that acknowledges that there are always both processes involved, we will arrive at clearer conclusions as to what needs to be done in terms of guidance/guidelines.
- Who is responsible and accountable? The better design guidelines we have for human-centred design of technical systems, the less we have the discussion about the topic as both are responsible to work together on the OSH aim. To be more precise with the guidelines, we need to make that distinction.
- Legislation should be up-to-date. The use of delegated acts by the European Commission is included now in the two proposals; e.g. in the 'AI Proposal', it concerns Annex 1 (definition of AI), and Annex 3 (list of specific high-risk); Machinery Directive: Annex 1 (high-risk machinery), Annex 2 (list of safety components).
- Do we have to approach the manufacturer/software programmer or the company that is implementing the technology? Who is accountable? Both, but in the initial stages, it is mostly the governance structure that must be in place and known; once it is accepted, it should be followed. At this moment, a lot of companies have implemented AI solutions and have their own governance structures around it. That's dangerous if they are not regulated or if there are gaps in regulation. To reach standard levels, it will require more iterations. The EU initiative 'Testing and Experimentation Facilities' is a good start. Within regulatory framework, active dialogue between both parties. Probably will not be a one-size-fits-all, first need to agree on a governance structure. Needs to be documented and then evolve in iterations. Providers that develop software should take into account OSH impacts. The development of software should respect EU law and principles; this is in the 'AI Proposal'. The providers should be aware of the risks. Example: software that talks directly to the worker. Currently, there is a free check on how to design something. When software is designed to be used on the workplace, risks need to be taken into account.

- There are two areas of legislation: OSH Legislation (Art.153) and Single Market Regulations and Directive (Art.114) – when you place a product onto the market, you need to think about how the product will be used and what risks this brings about. The manufacturer must anticipate the design of the product cycle and take responsibility for the lifecycle of the product and its risks. This is also the view of many other organisations, such as the German Trade Union Federation. When it comes to delegated acts – we were in the past not able to update the high-risk machinery, because not part of the delegated acts; developments continued, but they weren't included in the high-risk list. This can be done now with the delegated acts. Serious opposition in the Committees against third party assessment. But it is important to have an authority that gives a certificate of conformity assessment for the user – it has to be from a third party. This is complex with AI.
- AI algorithms are so complex that the following question arises: at which level do you certify?
- Today, there is not the expertise to fulfil this job. Right now, draft will go into legislation. It will at least take two more years until we see the law. Then, another transition period until it really gets implemented. This time should be used to raise level of expertise in the notified bodies and in the Member States. There are few approaches that need to be further developed. Some good examples, e.g. Fraunhofer Institute. We need to face the challenge, not let it be.
- It is important within Europe that we do not get too carried away with regulation that hampers innovation. We need to allow innovation to happen, and then regulate after. It will be very difficult to legislate changes in the future because these changes cannot be predicted. It is easier for the regulator to regulate if there are third party assessments. Because the regulator themselves do not have the expertise to assess.
- The Commission, following the AI Act is currently working on the design of functioning regulatory sandboxes. It is work in progress, so they welcome cross-national discussions. We must start building capacity, as companies have already implemented AI and we have to catch up as we are lagging behind.
- If legislation will take more than four to five years from now, then there is the risk that in the meantime developments are very fast. Not every MS is as far as Slovakia, and every MS has different priorities. We will see exponential evolution in the future of technology developments. What can we do in the meantime, until the legislation is fully developed and then implemented? How can we mitigate the concerns from OSH bodies, etc.? Because in the Machinery Directive, the real challenge is putting the machine in the middle. Not so positive – is there not the risk that legislation will come too late, at a point where technology is already in use? It will be very difficult ex-post to forbid use. Then the market will be more powerful than the workers' rights, which we can already see. Nowadays, it is quite difficult to predict the development. Therefore, we need to change the culture – this starts with early childhood education.
- Situational awareness is a challenge or risk. When one talks about AI-based systems, the term becomes broadened beyond organisational limits. It is important to understand how an organisation ensures that people have trust in the system. The modernisation of OSH rules is in the process until 2023. Look at the installation from a holistic point of view; companies that design such systems 'disappear', become integrated into bigger ones – discontinuing maintenance; incompatibility of software and hardware – advanced robotics are used with older machines, with integrated machine systems; need to see the lifecycle perspective, the compatibility aspect, and the incident reports. How incidents are reported, how to find root causes. Sometimes we get carried away by the definitions – these are important for the laws, which will remain in place over the next 10 years.
- Various sectors will benefit from automation (e.g. agriculture, heavy machinery, climate change), but we should exclude communicative tasks.
- It is not about the technology, but about how it will be implemented. Reality is that technologies are only adapted in a way that they raise productivity – but this is not necessarily always in line with OSH goals. There is much more pressure on workers, space for self-efficiency and contribution of workers; AI is trained for specific tasks, and this limits the worker's flexibility. We need both strong legislation and strong enforcement.

Findings of the fruitful discussion wrapped up:

- Current recommendations from European and International organisations are at a very high level – our recommendations should go into more detail;
- It is important to talk to the software developers, but also to the people who implement the technology;
- Possibility of delegated acts might be a solution to keep up with rapid developments, although it's a tough race;
- Where to implement these systems first is where people are at high risk from a physical point of view, but also from a cognitive point of view.
- The role of the enforcement authorities needs to be emphasised. There are challenges for traditional labour inspectorates to enforce this kind of legislation and to be able to identify these kinds of systems. But it is also about the use of systems – how do the systems comply with workers in the workplace? Even with traditional technologies there are a lot of risks associated with the misuse, which will further escalate with the use of AI-based systems.