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INAIL

Digital Integration in Machines and Process Industry

Industry 5.0 design of Human- Machine Interaction

Eng. Alessandra Ferraro
Dit - Lab IV

Rome, July 7th 2023
Inail, “Sala del Parlamentino”, 1st floor
Via IV Novembre, 144

INDUSTRIA 5.0

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*Industry 5.0 recognises the power of industry to achieve **societal goals** beyond jobs and growth to become a provider of prosperity, by making production respect the boundaries of our planet and placing the **wellbeing of the industry worker at the centre of the production process**.*

Mariya Gabriel,
Commissioner for Innovation, Research, Culture, Education and Youth

INDUSTRIA 4.0 → 5.0

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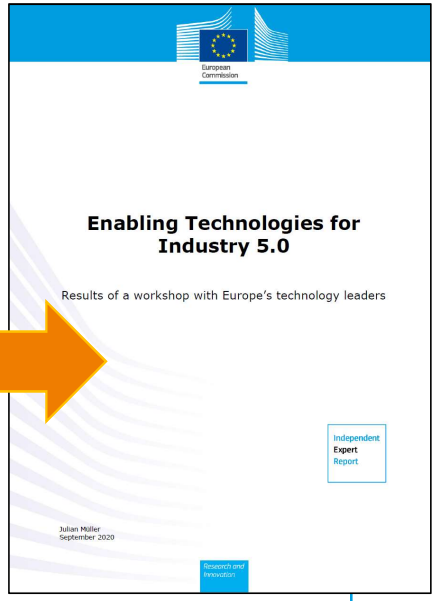

European Commission

- Individualised Human-machine-interaction
- Bio-inspired technologies and smart materials
- Digital twins and simulation
- Data transmission, storage, and analysis technologies
- Artificial Intelligence
- Technologies for energy efficiency, renewables, storage and autonomy

HUMAN-MACHINE INTERFACE

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The hardware or software through which an operator interacts with a controller. An HMI can range from a physical control panel with buttons and indicator lights to an industrial PC with a color graphics display running dedicated HMI software.

*Bric ID 40 - 2019

HUMAN MACHINE INTERACTION

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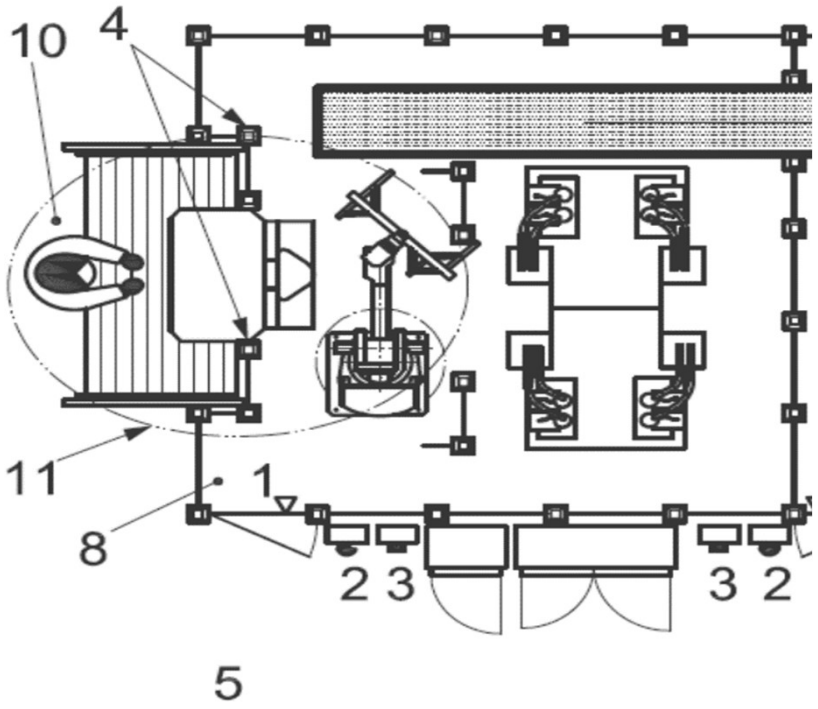

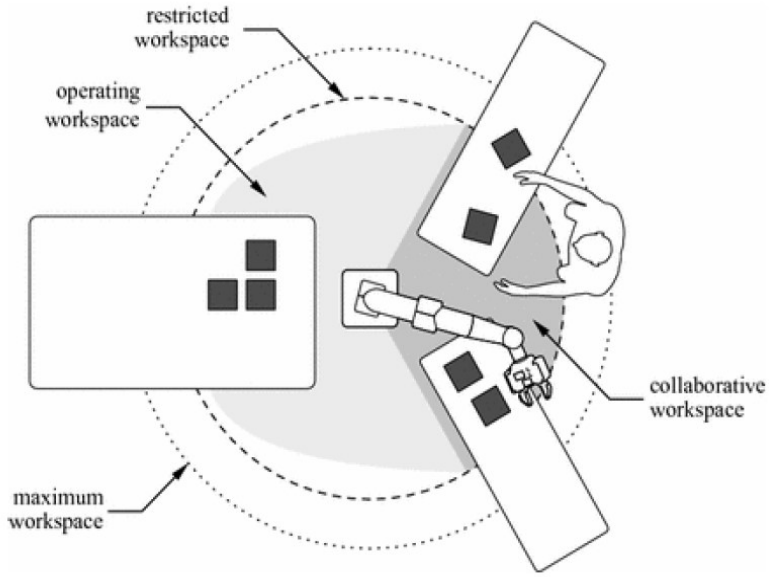

*UNI EN ISO 10218-2:2011 Robot e attrezzature per robot – Requisiti di sicurezza per robot industriali
Parte 2: Sistemi e integrazione di robot

HAND GUIDING
COLLABORATIVE APPLICATION

HG: the robot shall operate with a safety rated monitoring speed function active. The safety rated monitored speed limit shall be determined by risk asssessment.

STIIMA
Sistemi e Tecnologie Industriali Intelligenti per il Manifatturiero Avanzato
Consiglio Nazionale delle Ricerche

ALMA MATER STUDIORUM A.D. 1088

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ISTITUTO NAZIONALE PER L'ASSICURAZIONE CONTRO GLI INFORTUNI SUL LAVORO

NEW REGULATION ON MACHINERY PRODUCTS

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Press room / Parliament adopts new rules to guarantee safety of machinery in the digital era

Parliament adopts updated rules to guarantee safety of machinery in the digital era

Press Releases PLENARY SESSION IMCO 18-04-2023 - 12:14

On Tuesday, Parliament gave its final approval to the new machinery regulation that was agreed on with the Council in December 2022.

The new rules adapt the existing legislative framework to the latest needs of the market and to emerging digital technologies, such as artificial intelligence. Their overall aim is to increase user-safety and improve predictability for the machinery industry, especially SMEs. They also encourage innovation, digital transition and consumers' trust.

List of machinery that requires more thorough conformity checks

The new rules introduce a stricter conformity assessment procedure for specific categories of machinery before these are placed on the EU market. This new procedure covers for example machinery with self-evolving behaviour (based on machine learning) and other categories of products mentioned in Annex I, Part A of the new regulation. For these

Further information

- Adopted text will become available here (18.04.2023)
- Procedure file
- Rapporteur Ivan Štefanec (EPP, SK)
- EPRS briefing "Ensuring machine

1.3.7. RISKS RELATED TO MOVING PARTS

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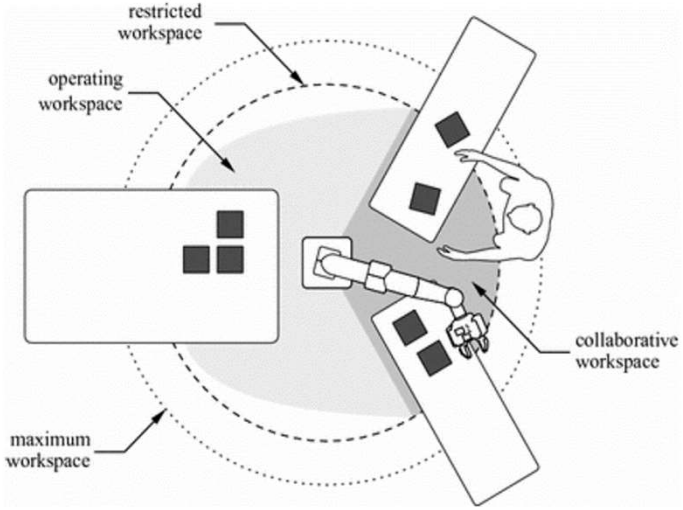
(…)The prevention of risks of contact leading to hazardous situations and the psychological stress that may be caused by the interaction with the machinery shall be adapted to:

(a) **human-machine coexistence in a shared space without direct collaboration**;

(b) **human-machine interaction.**



1.1.6. ERGONOMICS

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Under the intended conditions of use, the discomfort, fatigue and physical and psychological stress faced by the operator shall be eliminated or reduced to the minimum possible, taking into account at least, the following ergonomic principles:

(….)

(g) where relevant, **adapting machinery** or a related product with intended fully or partially self-evolving behaviour or logic that is designed to operate with varying levels of autonomy **to respond to people adequately and appropriately** (such as verbally through words and non-verbally through gestures, facial expressions or body movement) **and to communicate its planned actions** (such as what it is going to do and why) to operators in a comprehensible manner.

1.3.7. RISKS RELATED TO MOVING PARTS

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to respond to people adequately and appropriately ……

The response must be proportionate to the input and the reaction or behavior to be determined, for example for:

- CALLING ATTENTION
- IMPROVING SITUATION AWARENESS

…..

THE COGNITIVE LOAD THEORY

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Performing a specific task requires a Mental Work Load (MWL) for the human cognitive system; Cognitive Load Theory (CLT) considers three main aspects

MENTAL LOAD	MENTAL EFFORT	PERFORMANCE
it refers to external events or factors that the operator cannot directly control (such as difficulty of task, environmental physical risks, types of display, layout of workplace, instructions)	it refers to either load or stress of operator. It depends on physiological characteristics of operator, background	it is the result of the work performed. If positive, it helps in learning new skills and improves human-machine interaction

1.3.7. RISKS RELATED TO MOVING PARTS

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Digital technologies integrated in machines and process plants allow:

- **Acquisition and analysis of operator data**
- **Simulating interaction to develop and improve risk assessment – task based**
- **Improving UX of systems**
- **Testing the effectiveness of systems**

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Working Group Scientific Research Activities (Program 6 – Objective 2 Operational unity 2)

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