Human factors when applying new technologies in machinery design: the “usability” challenge

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The ETUI is financially supported by the European Union

Directive 2006/42/EC
Machinery Working Group
Doc. WG-2019.52
The impact of advances in robotics, artificial intelligence, automation and autonomous applications on the human-machine interaction; the role of human-machine interface when machinery is networked with information and services to form integrated systems;
Manufacturers and market surveillance authorities’ uneasiness and distrust about human factors and ergonomic principles;
ETUI's views on the possible revision of the Machinery Directive

The contribution of Research and Standardization
The concerns of Small and medium-sized enterprises (SMEs)
ETUI's views on the possible revision of the Machinery Directive

Senior employment
(as % of the population aged 55 to 64)

Issues(5)
Mutual misconceptions between designers and operators of hazardous installations.
Facts(1)

Strategy for risk assessment and risk reduction

The objective to be met is the greatest practicable risk reduction, taking into account the four below factors:

I. the **safety** of the machine during all the phases of its life cycle;
II. the **functionality** of the machine;
III. the **usability** of the machine;
IV. the **costs** (manufacturing, operational and dismantling) of the machine.

The process itself is **iterative** and several successive applications can be necessary to reduce the risk, making the best use of available technology.

The ideal application of these principles requires knowledge of the **use** of the machine, (...)

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Total Risk of the machine:

- For all man-machine activities
- For all hazards potentially caused by control system failure
- For all relevant machine components
- For the whole lifetime service

\[
\int R(t) = F[S, Ex, O, Av, l]
\]

\[
F = \text{non-linear}
\]

- \( R(t) = \text{Risk} \)
- \( S = \text{Severity} \)
- \( Ex = \text{Frequency/duration of exposure} \)
- \( O = \text{Rate of occurrence of a hazardous event} \)
- \( Av, l = \text{Probability of avoiding/limiting harm} \)

\[
= R(\text{Usability})
\]

\[
= Ex(\text{Usability})
\]

\[
= Av, l(\text{Usability})
\]
1.1.2. Principles of safety integration

(a) Machinery must be designed and constructed according to human-centred principles so that it is fitted for its function, and can be operated, adjusted and maintained without putting persons at risk when these operations are carried out under the conditions foreseen but also taking into account any reasonably foreseeable misuse thereof.

The aim of measures taken must be to achieve productive, safe, usable machinery, and to eliminate any risk throughout the foreseeable lifetime of the machinery including the phases of transport, assembly, dismantling, disabling and scrapping.
1.1.6. Ergonomics

Under the intended conditions of use, the discomfort, fatigue and physical and psychological stress faced by the operator must be reduced to the minimum possible, taking into account ergonomic, human factors, and usability knowledge and principles such as:

- allowing for the variability of the operator's physical dimensions, strength and stamina,
- providing enough space for movements of the parts of the operator's body,
- avoiding a machine-determined work rate,
- avoiding monitoring that requires lengthy concentration,
- adapting the man/machinery interface to the foreseeable characteristics of the operators.
- involving users during machinery design and development
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Thank you