Croatian Ergonomics Society

BOOK OF ABSTRACTS

10th INTERNATIONAL ERGONOMICS CONFERENCE

ERGONOMICS 2024

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10th International Ergonomics Conference - *ERGONOMICS 2024*

The Conference is **organized by**:

CROATIAN ERGONOMICS SOCIETY

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ERGONOMICS 2024

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Editor's Note

The post-conference Proceedings titled "*Proceedings of the 10th International Ergonomics Conference*" is going to be published by the Springer Publishing Co. in the series "Springer Series in Design and Innovation" and contains reviewed and accepted full text papers. The best high-quality papers from the conference will be selected for publication in the following journals: Interdisciplinary Description of Complex Systems (ISSN online: 1334-4676, ISSN printed: 1334-4684), Technical Journal (ISSN online: 1334-4676, ISSN printed: 1334-4684), Traffic & Transportation, (ISSN online: 1848-5588, ISSN printed: 1846-6168) and Sigurnost/Safety (ISSN online: 1848-6347, ISSN printed: 0350-6886).

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Preface to the Book of abstracts

Dear colleagues and dear friends!

The Croatian Ergonomics Society (CrES) has organized the **10th International Ergonomics Conference - ERGONOMICS 2024** in Zagreb, Croatia. We are proud that this conference is part of the series "Ergonomics" organized by CrES since 2001 with the aim of promoting ergonomics worldwide. The fact that we are in Zagreb in December, when the world-famous Zagreb Advent season is back in full glory, makes this venue and the conference even more special. These Conference is special since it is tenth conference and also Croatian Ergonomics Society is celebrating its 50th anniversary.

The organization of the conference is traditionally a joint project of the four faculties - University of Zagreb Faculty of Transport and Traffic Sciences, University of Zagreb Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb Faculty of Textile Technology and University of Zagreb Faculty of Graphic Arts. As in previous years, the conference is endorsed by the International Ergonomics Association (IEA), the Federation of European Ergonomics Societies (FEES), the Acoustical Society of Croatia (ASC) and the Centre for Registration of European Ergonomists (CREE). Furthermore, it is supported by: Polish Ergonomics Society, Ergonomics & Workplace Management Society, Chinese Association of Ergonomics Societies, Ergonomics Society of Taiwan, Hong Kong Ergonomics Society, and Chinese Ergonomics Society.

This conference has consistently brought together enthusiasts, experts, and scientists from both Croatia and around the world. Over the years, our Ergonomics community has grown. We always eagerly look forward to meeting old friends and making new acquaintances here. At this year's edition of the conference, participants came from 24 countries, namely Croatia, Ukraine, Latvia, Algerie, Macedonia, Belgium, Slovenia, Slovakia, Columbia, United states of America, Nigeria, Vietnam, Philippines, Malaysia, Tunisia, South Africa, Senegal, Peru, Germany, Japan, Indonesia, Romania, Austria and Italy.

All submissions were reviewed and 54 abstracts were accepted for publication and presentation at the conference. The post-conference Proceedings consist of double peer-reviewed full texts of the accepted abstracts and will be published by the Springer Publishing Co. as " Proceedings of the 10th International Ergonomics Conference " in the series " Springer Series in Design and Innovation". The best high-quality papers from the conference will be selected for publication in the following journals: Interdisciplinary Description of Complex Systems, Technical Journal, Traffic & Transportation, and Sigurnost/Safety.

As the President of CrES and Conference President, I want to extend my heartfelt gratitude to the members of the conference committees for their dedication in organizing this event, as well as to all the supporting organizations whose efforts have once again made this "Ergonomics" conference a reality and a success. I also sincerely thank all the participants for their invaluable contributions, which bring the conference to life and give it true meaning.

We trust that all participants had an enjoyable stay in Zagreb, leaving with inspiring experiences and innovative scientific ideas. Building on the success of the past two decades, we warmly encourage you to join us for our 11th conference and to share this opportunity with your colleagues, helping our Ergonomics community flourish further.

Sincerely,

Asst. Prof. Jasna Leder Horina, PhD
President of the Croatian Ergonomics Society
Ergonomics 2024 Conference President

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Invited speakers:

Session Papers:

CLIMATE ERGONOMICS: PREPARING FOR THE NEXT 50 YEARS

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Abstract

Perhaps the biggest challenge facing humanity (and therefore workers) through the twenty-first century will be related to climate change; how we reduce its impacts and adapt to the coming changes. This paper outlines the case for anthropogenic climate change and the role of ergonomics/human factors (E/HF) in mitigating the worst impacts of climate change and adapting to its unprecedented consequences. Climate change will impact everyone and E/HF needs to be ready to play it's part in reducing the possibilities for catastrophic change and being prepared to offer design advice to protect workers from harm. Broadly the climate change impacts will include working under heat conditions, work under UV intensification, work in conditions with new pathogens and allergens, and work in extreme weather conditions. However, each country and region will have their own specific challenges and foci, as well as pre-existing adaptive capacities. This paper uses Croatia as a case study to show how E/HF can provide a conduit to understanding these nuances and to draw from indigenous knowledge systems. This includes examples of E/HF technological, organisational, and personal interventions, drawn from E/HF knowledge, that can be form a starting point to help protect workers from these climate change impacts.

Keywords: *climate change, climate adaptation, climate mitigation, heat stress, water scarcity*.

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WHAT HFE RETURN OF EXPERIENCE TELLS TO INDUSTRY 5.0

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Abstract

Our civilisation has experienced numerous technological changes throughout its history. Regardless of what perspective we take on their benefits, it is undeniable that each change has brought upon social changes that were unforeseen and often even undesirable. One can only wonder about the anxieties of previous generations as they experienced similar social changes. Still, somehow, the scale and depth of transformation that looms today seem to touch upon the social fabrics in ways that are unprecedented. Therefore, considering problems and challenges should begin with how social values and ethics are brought into question before projecting any form of organisation or structure under an idealised technological future. Current discourses emphasise that Industry 5.0 will present a more ethical vision, integrating sustainability, environment, and social aspects. In Industry 5.0, rather than basing business strategy on a logic of production performance, humans should be the driving force behind factory competitiveness. In this approach, taking the environment into account has become a stake. New waste recovery methods are possible, as well as using renewable energies or integrating sensors to reduce energy consumption. But how should these goals be achieved? How are such technical solutions to be developed and implemented so that they are effectively placed at the service of such goals? What is being considered in terms of the social transformations that are needed to ensure that effectiveness? There seems to be an underlying belief that technological solutions will put in motion the necessary transformations at all levels or that other aspects of that transformation are of minor importance and will not compromise the effectiveness of Industry 5.0 vision. History has shown countless times that this is unrealistic and that more interdisciplinary and integrated approaches are needed. Perhaps even more so than at any other previous era of transformation, given the depth and breadth of the foreseeable impacts. The technical approaches that we have been able to listen to give no information on these issues. Our profession has a lot to say and do about this. The presentation will show the framework within which we can act and provide an illustrated example of the necessity of including human functioning in design.

Keywords: *human factors, design, industry 5.0, return of experience.*

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EYE-TRACKING IN ROAD SAFETY RESEARCH

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Abstract

Eye tracking has emerged as a powerful tool for researchers to gain insights into visual attention patterns and decision-making processes of drivers in various traffic scenarios. This keynote speech will discuss the methodology of eye-tracking studies in road safety, including both simulator-based and real-world driving experiments. Moreover, it will present several studies covering different topics – from distraction to the impact of road infrastructure on driver behaviour, conducted at the Faculty of Transport and Traffic Sciences, University of Zagreb (Croatia). The presentation will conclude by addressing the challenges and limitations of eye-tracking technology in road safety research and discussing future directions for this rapidly evolving field. By leveraging eye-tracking technology, researchers and practitioners can contribute to the development of more targeted interventions and strategies to enhance road safety for all users.

Keywords: *eye-tracking, road safety, driver behaviour, road infrastructure.*

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ERGONOMICS ISSUES IN AI SYSTEMS

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Abstract

The world never stops moving and is always changing. We are entering the AI era in which AI is replacing some of the human functions to an unimaginable level. However, new technology creates new ergonomics needs that usually will be aware of and be satisfied until relatively later time. It would be most beneficial if ergonomics issues and needs could be identified before or during the beginning of a new technology innovation. In this presentation, some ergonomics issues that may be involved in the AI systems will be suggested and discussed.

Keywords: *ergonomics issue, ergonomics needs, ai system, new technology.*

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THE LEVEL OF NOISE IN BLACKSMITHING WORKSHOPS IN OUM EL BOUAGHI PROVINCE, ALGERIA

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Abstract

This study examines noise levels in 40 blacksmith workshops in Oum El Bouaghi, Algeria, using a sound level meter to assess occupational noise exposure. Results reveal significant variations in combined noise levels among machine pairings. The highest noise level, 108.1 dBA, was recorded when the Manual Cutting Machine (106 dBA) was paired with the Fixed Cutting Machine (102 dBA). Similarly, the Hammer (106 dBA) and Fixed Cutting Machine (104 dBA) produced 107.1 dBA. Pairings with larger dBA differences, such as the Drill (94 dBA) and Fixed Cutting Machine (106 dBA), generated less cumulative noise, demonstrating the effectiveness of strategic pairings. Noise levels frequently exceed the 90 dBA permissible limit, posing health risks such as hearing loss, mood disturbances, and reduced productivity. Recommendations include providing hearing protection, scheduling high-noise machines separately, and investing in noise-reduction measures like sound barriers and absorptive panels. Regular machine maintenance, designated noise zones, and visual communication cues are essential for reducing exposure. Promoting a safety culture and conducting routine noise assessments ensures a safer, more productive work environment.

Keywords: *blacksmith workshops, noise exposure, occupational health, noise levels.*

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USAGE OF DRONES FOR ROUTE SURVEILLANCE IN SHUNTING OPERATIONS

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Abstract

The rail freight traffic plays a key role in fulfilling the climate targets in the transport sector. An important part within the rail freight operation is the train preparation and train disassembling. Here, numerous manipulation processes are necessary to disassemble and form trains. These shunting processes are time-consuming and staff intensive. The activities carried out are sometimes dangerous and unattractive for employees. This poses challenges for railway companies, particularly in terms of existing staff shortages. Within this paper it is researched how this challenge can be countered using technical solutions. Therefore, it is investigated how shunting can be supported with drones. For this purpose, existing use cases are considered in which it is necessary for an employee to accompany the shunting process. These existing processes are compared with future processes in which this activity can be performed by drones. It is shown that the use of drones with video recordings and the use of artificial intelligence can provide useful support for the driver. This paper summarises that individual innovations make shunting more attractive, but the key factor is the combination of different of these system solutions, which together enable significant improvements.

Keywords: *shunting, drones, single wagon load traffic, railway staff safety, DAC.*

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MANAGING REMOTE WORKERS' WELL-BEING: A RISK-BASED PRACTICAL APPROACH

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Abstract

The COVID-19 pandemic has introduced new emergent risks due to the acceleration of the digital transformation and the new paradigm of remote (online) work specifics. This article explores the challenges and risks associated with remote work, particularly focusing on social isolation and digital alienation. It highlights the impact of these factors on mental health, occupational stress and presents strategies to mitigate their negative effects. The study includes a literature review, a survey based on a designed questionnaire conduct-ed by the partners from Romania, Slovenia, Austria and Croatia that support the VirtualEDU ("Upskilling and certification scheme for virtual educators", Erasmus+ KA220-HED - Cooperation Partnerships in Higher Education, 2022-1-RO01-KA220-HED-000086331) project implementation, and practical recommendations for improving remote work environments. Key areas addressed include time management, effective communication, and digital competencies. The findings aim to provide a comprehensive understanding of remote work occupational emergent risks and offer solutions to enhance their well-being.

Keywords: *remote work, social isolation, digital alienation, well-being, risk management, occupational health and safety, virtualEDU project.*

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AUGMENTED REALITY USED IN SAFETY TRAFFIC MANAGEMENT

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Abstract

The article aims to provide a ready to use methodology for the integration of Augmented Reality (AR) in safety and ergonomics approach for optimizing safety and risk management in the warehouse logistics. AR technology enhances user experience by optimizing cognitive ergonomics competencies of the drivers. In logistics and traffic management, AR technology is used to improve operational efficiency and safety. The research methodology is based on ISO 45001:2018 and ISO 19011:2018 standards and involves a safety traffic audit to identify and mitigate potential hazards in a warehouse setting. Based on the findings and recommendations measures, there is presented a solution for implementing the AR and AI technologies in warehouse logistics to improve safety and efficiency of forklift working systems. Final conclusions underline the transferability of the research approach and the high-tech solution in other working systems.

Keywords: *traffic management, audit, cognitive ergonomic, safety, logistics, augment reality.*

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DIFFERENCES IN HEAD HEIGHT OF THE KINDERGARTEN CHILDREN

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Abstract

The canons of the human body and the established head-to-body ratio have been the subject of research in art and science throughout the centuries. However, head-to-body proportions in children, which could develop new knowledge about anthropometry and facilitate later application in product design, have not yet been confirmed. To determine children's canon and head height, a study was conducted in which kindergarten children from 2 to 7.5 year of age participated in three major cities (countries): Sofia (Bulgaria), Skopje (N. Macedonia), and Zagreb (Croatia). It was concluded that there are differences in the growth of head height concerning the age and gender of the child, and they follow the expected growth curve of children, and on aver-age the differences are greater in boys.

Keywords: *child anthropometry, kindergarten, children, head height, proportion.*

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ERGONOMICS IN LINEMEN ACTIVITIES: A PROPOSAL FOR THE REDESIGN OF A TELESCOPIC POLE

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Abstract

Maintaining electrical towers is critical for a stable power supply but presents substantial risks to linemen's health and safety. In 2020, the Peruvian Ministry of Labor documented 1,508 occupational accidents in the electrical sector, representing 4.6% of all workplace incidents nationwide. This study aimed to analyze the ergonomic conditions of linemen engaged in tower maintenance, specifically addressing issues associated with the telescopic pole. Using a mixed-methods approach, we applied User-Centered Design tools, such as journey mapping and interviews with linemen from Peruvian power transmission companies, to uncover ergonomic challenges and operational experiences. Ergonomic risks were assessed through Rapid Entire Body Assessment (REBA) and Hierarchical Task Analysis (HTA), revealing that tasks involving safety, electrical voltage handling, and temporary line positioning are time-intensive and high-risk. The telescopic pole emerged as a primary ergonomic issue, hindering task efficiency and safety in power line maintenance. These findings highlight the urgency for improved ergonomic solutions; consequently, a motorized pole design was proposed to enhance working conditions, minimize injury risks, and streamline maintenance processes.

Keywords: *linemen, user-centered design, telescopic pole, electric towers, ergonomics, electrical safety*

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ERGONOMIC RISK FACTORS AMONG RICE FARMERS IN THE PHILIPPINES

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Abstract

This study examines the ergonomic risk factors among rice farmers. It aims to identify the rice farmers' demographic profile and prevalence of work musculoskeletal disorders among rice farmers, assess the ergonomic risk level experienced by farmers, determine the correlation between the demographic profile and the pain level, and ascertain ergonomic interventions to reduce risk factors for rice farming tasks. Comprehensive ergonomic risk assessments were conducted using Nordic Musculoskeletal Questionnaires (NMQ), Rapid Entire Body Assessment (REBA), and Rapid Upper Limb Assessment (RULA). Nordic Musculoskeletal Questionnaires revealed that all participants reported experiencing lower back pain and discomfort within the past 12 months and 7 days (100%); hips were identified as the body areas with the highest pain intensity (8.94). Meanwhile, the REBA score reveals that the task of planting had the highest score of 12; on the other hand, all farming tasks received a score of 7 in RULA, which signifies a very high level of risk. Correlation analysis revealed weak and non-significant associations between pain levels, weight, height, and work duration per day. Age and years of experience, on the other hand, showed a positive relationship and statistically significant correlation with pain levels. The recommended control measures to mitigate ergonomic risk among rice farmers include proposing a job rotation system, administering a training and education program, implementing a tool or equipment modification, and employing safety footwear. Memory capacity and mental workload in different class settings emphasize the importance of considering these factors when designing and delivering effective teaching modalities.

Keywords: *ergonomic intervention, Nordic Musculoskeletal Questionnaires, postural discomfort, REBA, RULA.*

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ERGONOMICS: EVALUATION OF ADDITIONAL WORK GENERATED BY AGRICULTURAL HANDLE TOOLS

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Abstract

Ergonomics characterizes ease in the use of tools thanks to their adaptation to users and their working conditions. Thus, it plays a very important role on the performance of users. Unfortunately, In West Africa, particularly in Senegal, the design of tools is artisanal and, therefore, does not take into account the future users. It is, therefore, important to make the design of these tools more formal by taking into account their performance in the early design stage. In this paper, a systemic modelling approach is proposed to take into account ergonomics at the early design stage of agricultural handle tools. Then, a performance indicator is proposed to evaluate the additional work induced by handle tools during agricultural work. To improve comfort during the use of agricultural handle tools and increase performance of users, the value of the additional work should be as low as possible.

Keywords: *ergonomics, systemic modeling for ergonomics, additional work, agricultural handle tools.*

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INTEGRATED COGNITIVE ERGONOMICS OF THE REMOTE EVALUATION OF THE GRAFTS WITH ROBOTICS AND MOBILE PCR ANALYZER IN SOLID ORGAN TRANSPLANTATION

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Abstract

Integrated Cognitive Ergonomics (CE) upon AI and mobile PCR instant analyzer to extend reliability of the integrated Tele-Radiological (TRE) and Tele-Pathological (TPE) evaluation of the Renal Graft (RG) of Prometheus Digital Medical Device (pn 2003016) via integration with PCR instant analysis novel device and Tele-Robotics (Stamoulis Rb) in the pre-transplant period of Organ Transplantation. A sensitivity-specificity analysis by a simulation of the TRE of RG on 15 MR abdominal images by a radiologist and of the TPE of RG by 26 specialists based on 130 human RG images assessing damages and lesions. The integrated analysis of TRE and TPE of RG showed: Sensitivity= 96.7%, Specificity=100% and Accuracy=97.6%. Integration of a mobile PCR analyzer for instant analysis of specific biomarkers such as the cfDNA (dd-cfDNA) based results pattern recognition and AI programming offers deep learning and may recognize better a possible organ failure and improve organ viability prognosis. The TRE integrated with TPE and real time PCR instant analysis of RG based results pattern recognition by AI programming and Deep Learning supported virtual benching is feasible and seems more reliable for instant morbidity-mortality and organ viability prognosis in renal transplant decision support and operational planning.

Keywords: *cognitive ergonomics, renal transplantation, real time PCR analyzer, AI, tele-robotics.*

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COGNITIVE ERGONOMICS OF THE PREHOSPITAL DAMAGE CONTROL RESUSCITATION UPON AI AND 5G INTERNET TO OPTIMIZE OUTCOMES IN CIVILIAN SEVERE TRAUMA SURGERY

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Abstract

Cognitive ergonomics (CE) upon 5G internet networks (5GIN), Artificial Intelligence (AI)/Machine Learning (ML) in the pre-hospital setting (PS), upon remote continuous monitoring (CM), to support the Golden Hour (GH) and optimize outcomes in Civilian Severe Trauma (CSTR).(PS) organization and care upon (5GIN) high bandwidths (10 GB/s) mobile tele-communication (mTC) experimented by simulation by ten (n=10) professional rescuers and trauma surgeons to evaluate feasibility, reliability, clinical usability for instant risk, prognosis and triage computation, decision support and treatment planning by (AI)/(ML) computations in (PS) (CSTR) upon six (n1=6) clinical cases on 19.05.2022, on 27.07.2022, on 24.06.2023 and 26.06.2023 and on 29.02.2024. Real time data sharing between rescuers and a simulating remote special emergency department of a trauma centre (ED)/(TC) established, combining both 5G-radio and-core network parts focusing on Damage Control Resuscitation (DCR) integrated with (CM) of vital signs. Transmission latency evaluated. Trauma severity scales computations by an Exp-Cobot based on Cloud Computing. The 5G IN) test revealed an average end-to-end round trip latency of 10 milliseconds (<1ms) which depends on the computing devices quality, their digital connection to (mTC) and inherent phenomena (LOS, Scattering, Frequency Hopping). The presence of a physician for advanced interventions in the PS is essential. (DCR) with remote real time evaluation and instant computation of (CM) markers in (PS) seems reliable. Remote (CM) in (PS) of (CSTR) integrated with AI/ML upon (5GIN) technologies for instant computation of decisive markers consist the (CE) to support the (GH) in (DCS) and optimize outcomes.

Keywords: *cognitive ergonomics, artificial intelligence, 5g internet networks, pre-hospital trauma care, continuous monitoring.*

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IMPLEMENTATION OF ARTIFICIAL INTELLIGENCE IN AVIATION ERGONOMICS: AN OVERVIEW

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Abstract

The application of artificial intelligence in aviation continually grows. The AI technology contributes to improving efficiency, safety, competitiveness, and many aviation organizations have already implemented AI solutions in various aspects such as air traffic management, aircraft maintenance, autonomous drones, flight demand planning, as well as in aviation ergonomics. Ergonomics is primarily focused on optimizing the interactions between humans and technology, their tasks, and their environments with the objective to improve comfort, safety, and productivity. In the case of aviation, ergonomics is mostly focused on the interaction between the pilot and the aircraft. First introduction of AI solutions in ergonomics produced extraordinary results by improving work environment, productivity and general well-being of employees. Developments in ergonomics using AI include use of AI-powered cameras, computer vision or wearable equipment that can analyze an individual's posture at their workplace, AI algorithms that can analyze an individual's work habits and suggest personalized ergonomic adjustments, AI algorithms that can process large datasets such as health records, incident reports, and ergonomic assessments to identify trends and patterns and help improve workplace conditions, AI-enhanced virtual reality that can be used for ergonomic training and assessment, etc. In aviation, the specific AI simulation software solutions, such as RAMSIS, are used to ergonomically design aircraft cockpit and ensure crew and passengers have the optimal reachability, operability and vision, by accurately simulating the posture and movement of flight and cabin crew, passengers, etc. The paper presents an overview of recent developments and implementation of AI in aviation ergonomics.

Keywords: *implementation, artificial intelligence, aviation, ergonomics.*

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ANALYSIS OF LIGHTING CONDITIONS IN STUDENTS' LABORATORY USING SIMULATION

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Abstract

The need to analyse lighting conditions arises from the importance of ensuring overall well-being in a given space. It is particularly necessary to examine lighting conditions in educational environments, as they significantly impact student performance and attention. Using simulation tools to analyse lighting conditions allows for the creation of a virtual working environment, where various lighting scenarios can be evaluated. This approach also enables the assessment of several quantitative parameters that cannot be measured in real space due to various constraints. This article focuses on the analysis of lighting conditions in a materials research laboratory at university, where proper lighting is crucial. The article also highlights opportunities for collaboration in analysing lighting conditions using real measurements and simulations as supportive tools. The introduction outlines the theoretical background of lighting condition analysis, followed by the adaptation of a simulation tool for practical analysis. The main section describes the measurements conducted, which serve as the basis for creating a virtual model of the working environment using the Relux simulation tool. The constructed virtual model, reflecting the real environment, subsequently identifies and analyses key quantitative parameters - intensity, uniformity of lighting, glare via RUG and daylight glare via DGP. The conclusion of the article evaluates the analysed lighting conditions in accordance with current legislative and normative requirements. Based on in-situ measurements, which recorded illumination levels between 519 lx and 682 lx, it has been determined that the legislative and normative requirements for lighting in educational facilities, specifically for conducting laboratory tasks, have been met. Additionally, a virtual analysis was performed to assess glare levels, which ranged from 0.16 to 0.21. This analysis also confirms compliance with legislative requirements. The results highlight an innovative approach to assessing various lighting factors, ensuring the creation of suitable conditions in the educational environment.

Keywords: *lighting conditions, laboratory, digital software solutions, relux, simulation.*

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USING A COMPREHENSIBILITY JUDGEMENT TEST TO ASSESS THE EFFECTIVENESS OF NEW GRAPHICAL SYMBOLS

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Abstract

Graphical symbols are commonly used in signage systems for public areas and city maps. The ability of the symbols to convey a clear and unambiguous message is crucial for their effectiveness, especially when they are intended for the tourists with specific needs. In this study, a comprehensibility judgement test was used to determine the interpretability of three new proposals for the city signage symbols. Ninety-six adults in the age range between 19 and 65 years with a diverse educational background participated in the experiment as evaluators. Two age groups and four education levels were used as independent variables. Contrary to expectations, the results showed no significant effect of age on the participants' judgement scores. In contrast, the judgement scores were influenced by the education level to a certain degree. Two major findings can be derived from the results. First, the judgement test confirmed an acceptable level of comprehension score for a new graphical symbol for the tourists with specific needs, which was reported in previous research, demonstrating its potential for practical application in future development of different signage solutions. Second, the results indicated that participants' education background should be taken into consideration when selecting the appropriate sample size in symbol comprehension testing.

Keywords: *interpretation, judgement, signage, symbol, user.*

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SAFETY PICTOGRAM ON THE PACKAGING DISPLAYED IN THE ADVERTISEMENT AND ITS EFFECT ON VISUAL PERCEPTION

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Abstract

Warning messages on product packaging play an important role in enhancing consumer safety. Previous studies have demonstrated a significant effect of pictorial safety messages on people's visual attention, highlighting the importance of picture-based design in the context of warning communication through packaging. However, limited attention has been given to packaging displayed in the advertisement, which this study aims to address. In our experiment, an eye-tracking device was used to examine the effects of the safety pictogram on participants' visual perception of an advertisement displaying a packaging for nutritional supplements. A comparison was conducted between two packaging designs (a packaging without the pictogram versus packaging with the pictogram). Eye tracking data (Time to First Fixation, Fixations Before, Total Fixation Duration, Fixation Count, Total Visit Duration) were recorded for each segment of the advertisement (Areas of Interest), and scan paths of each participant were analysed. The results showed that the participants allocated visual attention to the safety pictogram, but their focus on the pictogram did not affect the noticeability of the advertised tagline and the brand name. These findings indicate that improving warning communication on packaging by pictorial safety message does not compromise the noticeability of the elements most important to advertiser.

Keywords: *safety, packaging, eye tracking, pictogram, attention.*

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POROSITY ASSESSMENT OF MELT ELECTROSPUN PLA

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Abstract

Melt electrospun materials are by far less explored than solution based ones, due to the challenges that come from both temperature and electrical voltage simultaneously. Within this respect, the fibers produced by melt electrospinning are much thicker than 1 micron. This paper focuses on the design of polylactic acid (PLA) microfilament materials melt spun on Spraybase, with previously generated 2D models in three different geometries. The PLA materials have difference in terms of filament densities (distance between the filaments of 0.5, 1 and 2 mm) and filament positions (vertical, vertical/horizontal, diagonal or at the angle less than 90°). The porosity of the materials is determined using microscope images of the samples and by analyzing their pore sizes and total void volume in ImageJ. The porosity is an important parameter that affects the thermal comfort evaluation of materials and it is dependent upon their e.g. thickness, filament diameter, filament distribution or geometry and pore sizes.

Keywords: *melt, electrospun, 2D models, PLA, microfilaments, porosity.*

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APPLYING GAME THEORY FOR WORK SYSTEM DESIGN: A PRELIMINARY MATHEMATICAL MODEL PROPOSAL

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Abstract

This study analyses the use of game theory in designing occupational health and safety (OHS) systems, focusing on Macroergonomics and stakeholder interactions. It shows the potential of game theory to model the relationships among government, employers, and workers. This can help promote safer workplace practices and regulatory compliance. This study employs multi-party evolutionary game models to identify balanced enforcement approaches. By integrating a Macroergonomics perspective, the research prioritizes human well-being and system optimization, advocating for proactive and cooperative strategies among OHS players: workers, employers, and the government, to enhance safety outcomes and societal well-being.

Keywords: *macroergonomics, game theory, work system design, ergonomics.*

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PROBLEMS OF TAKING INTO ACCOUNT HUMAN FACTORS IN CYBER-PHYSICAL SYSTEMS

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Abstract

The purpose of the article is to study the role of humans in cyber-physical systems and to develop a methodology for assessing the reliability of human-machine interaction and searching for ergonomic reserves to improve the efficiency of cyber-physical systems. The increasing role of a human in cyber-physical systems and the need for special attention to the problems of ergonomics and problems of taking into account the human factor are shown. The need for a human-system approach to the design and operation of cyber-physical systems is proven. A list of indicators of reliability and efficiency of cyber-physical systems is given. The possibility of using a human-machine interaction model built on the principles of "functional networks of Professor A.I. Gubinsky" is demonstrated for ensure the efficiency and ergonomics of cyber-physical systems. The principles of controlled functional networks for managing human-machine interaction in cyber-physical systems are described.

Keywords: *cyber-physical system, operator 5.0, ergonomics, reliability, decision support system, simulation, human factors.*

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HUMAN FACTOR IN E-LEARNING. CHALLENGES AND METHODOLOGY FOR ERGONOMIC SUPPORT

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Abstract

The purpose of the article is to identify ergonomic problems arising in connection with the rapid implementation of e-education and the use of gadgets and to propose a methodology for ergonomic support of e-learning. The development of e-learning is characterized. The problem of security in educational environments is shown. The need to consider a student as an operator of the "human-electronic learning environment" system is proven. Based on the generalization of a large number of developments by the authors, a new methodology for ensuring the ergonomics of e-learning has been developed. The methodology is based on the principles of ensuring cognitive comfort and the use of models such as "functional network". The method to optimizing human-machine interaction in e-learning systems is described.

Keywords: *e-learning, ergonomics, reliability, simulation, human factor, digital twin, optimization.*

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EXPERIMENTAL INVESTIGATION OF SURFACE AND PADDING OF A FOREARM SUPPORT OF A SURGICAL ARM ASSISTANCE SYSTEM

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Abstract

Surgery often results in uncomfortable arm and upper body postures, placing high strain on the upper extremities and leading to musculoskeletal disorders, which can impact precision tasks. A surgical arm assistance system physically relieves the upper extremities during surgical procedures, by actively supporting the forearms. Research shows an advantage of a percentile-adapted anthropomorphic forearm support shape over a flat forearm support and over no forearm support.
Within this research paper, nine material combinations consisting of three surface materials (medical synthetic leather, neoprene, sterile foil) and three padding materials (solid gel, neoprene, foam) are being analysed in two differently sized anthropomorphic forearm support shapes and a flat shape. 31 test subjects perform randomised dynamic and static precision tasks with and without surgical gown using the material and shape combinations.
In the dynamic task execution the most errors occur with the surface material sterile foil. The lowest average number of errors occurs with medical synthetic leather as the surface. In combination with the three surface materials, the lowest number of errors occurs with the padding material solid gel, followed by foam and neoprene. The best comfort rating (7-point bipolar Likert scale) occurs in the combination of neoprene surface and solid gel padding. The results of the statistical analysis of the test parameters are used to derive surface and padding material recommendations for the design of a forearm support shape for the interaction with arm assistance systems.

Keywords: *arm assistance system, exoskeleton, human-machine interaction, forearm support, surface, padding, surgery.*

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SYSTEMIC RISK ASSESSMENT OF MUSCULOSKELETAL DISORDERS IN MECHANICS DURING BRAKE SHOE REPLACEMENT ON INTERPROVINCIAL BUSES

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Abstract

Background: Accidents involving interprovincial buses are a significant road safety issue, with mechanical failures in brakes and brake shoes being the most common causes. Due to its complexity, the development process of these maintenance activities is not well-studied. This potentially exposes mechanics to system factors that increase the risk of musculoskeletal disorders (MSD). Aim: The study used a systems approach to investigate the risk of musculoskeletal disorder (MSD) in mechanics workers who change brake shoes on interprovincial buses. Materials and Methods: A mixed-method study was conducted. The research tools included semi-structured interviews and structured field observations. Information was categorised using a systems model based on Smith and Carayon and organised through Hierarchical Task Analysis (HTA). The REBA method was applied to the sequence of activities, and the MAC tool was used to assess the risk of MSD in manual handling. Result: Barriers and facilitators were identified, such as inadequate tools and improvised tool design without validation, the lack of space to make shoe changes, and empirical knowledge about the techniques without technical procedures. Postural overload (REBA >8) was also observed during more than 70% of the activities, and manual handling of loads with risk (MAC >16) when handling pneumatic guns. Conclusions: Mechanical workers are exposed to work system risk factors that contribute to a high incidence of MSD when performing shoe-changing tasks. The study proposed a low-fidelity prototype articulated knee brace to represent the reduction of knee effort to facilitate correct positioning during brake shoe change.

Keywords: *ergonomic, systems model, activity analysis, bus maintenance.*

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ERGONOMIC INDICATORS OF PHYSICAL STRAIN FOR INDUSTRIAL WOODWORKING ENTERPRISE EMPLOYEES IN RELATION TO WRMSD-S

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Abstract

Work-related musculoskeletal disorders (WRMSDs) are major health problems for employees. This research addressed the importance of Ergonomics Indicators of Physical strain that can help to analyze WRMSDs in every work process of Industrial enterprise. Well-designed ergonomic work environment is beneficial for workers' health, quality, and productivity. The aim of the study was to investigate and determine ergonomic indicators of physical strain in woodworking enterprises by assessing the intensity of the workload in timber lifting and sawing processes. The research sample consists of 2 medium-sized furniture companies. Survey and Key indicator method were applied to identify and analyze ergonomic indicators. Results show that main physical strain indicators for industrial enterprise employees in woodworking organisations are work posture, frequency of heavy lifting, load weight, lifting conditions and work organizational issues. The assessment of posture, work intensity, frequency of movements and organisational risk assessment should be taken into account when determining physical activity indicators for workers in the woodworking industry.

Keywords: *ergonomics, physical load, woodworking, industry, indicators.*

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RECONFIGURING THE INTERIOR OF A TESLA MODEL 3 FOR AUTONOMOUS DRIVING PURPOSES

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Abstract

The highly likely spread of autonomous vehicles has transformed the landscape of road travel, ushering in new opportunities and challenges in vehicle interior design. By removing the need for direct driver intervention, a wide array of Non-Driving-Related Activities (NDRAs) has become possible. These activities encompass working, studying, relaxing, and socializing during the ride, elevating the car from a mere instrument of transportation to an extension of our daily living space.
In this context, this study aims to propose a new design for the Tesla Model 3, envisioning its evolution to SAE Level 5 autonomy, which denotes full autonomous driving capability under any conditions and in any location. We have selected the Tesla Model 3 for examination due to its compact size, posing a significant challenge for interiors' optimization.
Starting with a critical review to identify the most pertinent activities for occupants, this study focuses on creating two virtual prototypes of the autonomous Tesla Model 3—one with 4 seats and another with 2 seats—to assess their spaciousness. 3D interiors model was created by CATIA V5 software, and the ergonomic evaluation was conducted using the Ergonomics Design & Analysis module, employing mannequins representing a 50 percentile French male and adopting REBA method for the virtual ergonomic assessment.

Keywords: *NDRAs, self-driving car, autonomous vehicle, ergonomics, comfort.*

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OPTIMIZING ARCHITECTURAL SPACE FOR A BETTER PATIENT AND HEALTHCARE STAFF FLOW TRAFFIC IN A PRIMARY HEALTH CARE FACILITY

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Abstract

Ergonomic interventions in support of architectural projects involve helping to define the working environment by placing work activity at the heart of the reflection on the future. The request for our intervention came from the staff of a multidisciplinary primary health care facility. The objectives of our intervention were to optimize space to improve care provision and meet the pressing demands of patients. This was a two-steps intervention. The first phase was an open observation of work activity, supplemented by a second phase of individual semi-directive interviews. Based on the results of the activity analysis, architectural adjustments were proposed. Our study revealed unequal and inadequate exploitation of spaces, resulting in a disorganized patient and healthcare staff flows. In addition, due to patients overcrowding noise levels were becoming disabling, both for patient examination and for staff comfort. Recommendations and conclusion: A new architectural plan was proposed and adopted by the ministry of health. This plan aimed to separate patient's flows by dividing the large waiting hall into two sub-areas and using the two existing entrances. This allowed us to separate pediatric consultation from adult consultation. Our recommendations included a forward-looking approach to anticipate future developments. A periodic evaluation of the job satisfaction of staff and that of users in the new care system to define the success or otherwise of the approach is crucial.

Keywords: *ergonomic intervention, health care facility, quality of health care, well-being.*

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SPATIAL AND TRAFFIC PLANNING FROM THE ASPECT OF MOBILITY AND ADJUSTMENT OF THE ENVIRONMENT FOR PEOPLE WITH REDUCED MOBILITY

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Abstract

An accessible built environment as well as public transport is a prerequisite for creating an inclusive society in accordance with the principles of the UN Convention on the Rights of Persons with Disabilities. Spatial-traffic plans, through an integrated approach, play a key role in creating an inclusive environment without obstacles through a just transition to climate neutrality, green mobility and digitization. The paper highlights the Sustainable Urban Mobility Plan, which defines guidelines and measures to meet the mobility needs of urban residents. The emphasis is on the adaptation of public transport and transport infrastructure for people with disabilities and reduced mobility, and the implementation of the plan in spatial plans of the new generation. Technical regulations and standards are analysed in this paper, furthermore key challenges are identified, and solutions are proposed to improve accessibility.

Keywords: *mobility and environment, sustainable urban mobility plans, spatial plans, people with disabilities and reduced mobility.*

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DEVELOPMENT OF STUDENT WORKPLACE THROUGH HARMONIZING DESIGN FOR ERGONOMICS AND PORTABILITY USING TRIZ METHODOLOGY

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Abstract

In product development, there are certain requirements need to fulfill that will benefit the user of the product itself. These requirements include functional, design and even ergonomic requirements. If all requirements are considered in a product, problems may arise due to some contradictions. An example of a product which has certain contradictory requirements is a student workplace. In this paper, student workplace is developed for students of Bulacan State University to enhance existing ones which are currently stationary and ergonomic requirements are not considered. Due to limited space in the university, the student workplace is aimed to be portable but must still satisfy ergonomic requirements for the students. To develop the product, the researchers planned four phases namely design conceptualization which utilizes Theory of Inventive Problem-Solving (TRIZ), prototyping, usability testing and product design improvement. Portability and ergonomic requirements were found to have some contradictions based on the design conceptualization phase and prototyping. The findings showed that these requirements can be harmonized using the solution presented by TRIZ methodology.

Keywords: *ergonomics, portability, student workplace, TRIZ, usability testing.*

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TOWARDS SUSTAINABLE ERGONOMICS FOR SUSTAINABLE BUSINESS: CASE OF INDONESIA'S SMEs

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Abstract

Sustainable ergonomics is an interdisciplinary approach that combines principles from ergonomics (the study of designing workspaces for human well-being) and sustainability (the pursuit of environmental, social, and economic balance). Sustainable ergonomics plays a crucial role in achieving sustainable business, not only in large companies but also small and medium enterprises (SMEs) which play a vital role in employment and economic growth. However, when it comes to implementing sustainable ergonomics, SMEs face unique challenges including lack of awareness and reluctancy to adopt ergonomic and sustainable practices. Indonesia has over 62 million SMEs, which are considered crucial to Indonesia's economy, accounting for around 97% of employment. However, there is still lack of attention to the practice of ergonomics and sustainability in Indonesia's SMEs. The focus of Indonesia's SMEs is mainly on making profits to ensure the sustainable business from the economic aspect, not yet putting effort to achieve balance on the environmental and social aspects. When it comes to the implementation of sustainable ergonomics, many work systems in Indonesia's SMEs are far from inevitable. In this paper, we discuss the evaluation of sustainable work systems in 17 Indonesia's SMEs in various sectors including food and beverages, fashion and apparel, textile, and furniture. The measures of sustainable work index in these SMEs showed the need to improve the practice of sustainable ergonomics in their daily business and manufacturing practices. This calls for immediate actions that can be taken by business owners to increase the sustainable work index in these investigated SMEs. We also provide suggestions of improvement for them on how they can help their SMEs thrive and ensure sustainable ergonomics.

Keywords: *sustainable ergonomics, sustainable work systems, SMEs, Indonesia, improvement actions.*

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INCREASING OBSERVERS' INTEREST AND COMPREHENSION BY USING EXPRESSIVE TYPOGRAPHY

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Abstract

A sizable portion of the population faces challenges in reading, stemming from a variety of cognitive, linguistic, and environmental factors. These challenges often include difficulties in decoding text, recognizing words, overcoming language barriers, and understanding sentence structure. Expressive typography employs visual cues within written words to create a synergy between text and image, with the goal of enhancing clarity and adding aesthetic value. This paper investigates the potential of using expressive typography as a tool to increase interest and comprehension of words or concepts. Eye tracking results show that samples presented as expressive typography generate more interest compared to regular typography, which can be a key factor for maintaining focus during cognitive processing. Questionnaire data reveal that most expressive typography samples are perceived as easier to comprehend. The findings of this paper suggest that expressive typography could be effective in various task-based scenarios. When correctly implemented, expressive typography may enhance understanding and prompt quicker actions in contexts such as warning signs, orientation, gaming, user manuals, language learning etc.

Keywords: *expressive typography, aesthetics and cognition, word design, reading, increasing interest*

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ASSOCIATION OF EVENING CHRONOTYPE WITH PREVALENCE OF NORMAL-WEIGHT OBESITY AMONG FEMALE UNIVERSITY STUDENTS

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Abstract

Individuals exhibit a time orientation, known as a chronotype, which is the latest (i.e., becoming an evening-type ET) in their 20s, such as university students. In a morning-oriented society, the sleep patterns of individuals with ET are affected, which can lead to health problems. Particularly in the age of mobile devices, ET students seem to use their mobile devices more often (especially before going to bed), which leads to sleep problems. We aimed to investigate the association between body composition problems and chronotypes in females. The study assessed the physical activity levels (PAL), dietary status, Morningness-Eveningness Questionnaire (MEQ) scores, and body composition of 251 students. Subsequently, 195 students with a body mass index (BMI) within the normal range (18.5–24.9 kg/m^2) were included in the analysis. Multiple regression analyses showed that the percentage of body fat (BF) was significantly negatively associated with the MEQ and PAL. Forty-nine of the participants were in the ET group (MEQ ≤ 41) and 47 in the non-ET group (MEQ ≥ 54 = mean + S.D. / 1.5), and participants with higher BF (≥30%) were more likely to be in the ET group (43% vs. 21%, P < 0.05). Such state of high BF despite a normal BMI is defined as normal-weight obesity. Therefore, young females (especially ET individuals) may be required to take chronotype-specific measures to help them maintain an appropriate body composition, such as the use of ergonomic devices.

Keywords: *body composition, body fat, body mass index, physical activity, Morningness-Eveningness Questionnaire.*

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ERGONOMIC ANALYSIS OF CHICKEN SALES IN A PERUVIAN POPULAR MARKET POULTRY SHOP

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Abstract

Objective: To analyze the task of chicken sales in a popular market poultry shop from the systemic perspective of ergonomics in order to provide solutions that optimize well-being and performance.
Methods: The sample consisted of 8 poultry workers from a popular market in Lima. A semi-structured interview, systemic ergonomics approach, and Hierarchical Task Analysis were employed. Physical and mental workload were evaluated. Additionally, anthropometric adjustment was assessed, and the Nordic Questionnaire was used to describe musculoskeletal discomfort in the workers. Results: Awkward postures were observed during customer payment due to the depth of the module and the location of the cash register beyond functional reach. In cutting and bagging tasks, risk from repetitive movements was identified, primarily due to the high pace of attention and time pressure. Forced wrist postures were observed when using the knife, along with different cutting techniques among poultry workers. Not only was physical workload identified, but also moderate mental workload. Incompatibility was observed with the depth of the service module, the height of the cutting table, and the height of the shelves. Musculoskeletal discomfort was reported in the wrists [88%], shoulders [88%], and neck [63%].
Conclusions: The work system lacks interaction with poultry workers regarding furniture design, tools, organization, and environment; this may explain the biomechanical physical workload, mental workload, and perception of musculoskeletal discomfort. Redesigning the work system, including modifications to the service module, cutting table, and manual tools, is suggested to optimize well-being and performance.

Keywords: *human factors and ergonomics, poultry, hierarchical task analysis, system analysis, physical workload.*

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ACTIVITY ANALYSIS AND PERFORMANCE OPTIMIZATION IN A SCREEN-PRINTING WORKSHOP

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Abstract

Lean management offers promising approaches to enhance productivity in manufacturing companies. Consequently, ergonomists are increasingly sought after to respond to requests to address the needs of companies adopting Lean management. The current intervention was carried out in a screen-printing workshop within one of Tunisia's largest totally-exporting weaving and clothing companies, which has embraced Lean management for nearly a decade. The initial request focused solely on increasing production in the screen-printing workshop. However, this was later expanded to include the relationship between production, workshop performance, and worker health and safety (44 employees). Following a diagnosis carried out on resources and cost dashboards; the analysis of the screen-printing activity was based on observations and interviews with managers and operators at various workstations. This analysis revealed discrepancies and existing gaps that exist between actual activities and the Lean processes and prescribed tasks for the different positions. Operators, with the tacit approval of managers, had introduced various individual and collective adjustments and regulations at different stages of production, from the receipt and sorting of cut pieces, preparation of film, prototypes, and color recipes; to drying, polymerization, inspection and shipping. Proposals for organizational and spatial transformation within the workshop were presented and validated by managers and operator representatives, in order to better align productivity and performance with the prevention of risks to workers' health, safety and well-being. The implementation of some of these proposals in the screen-printing workshop has yielded positive results in terms of performance metrics and operator satisfaction.

Keywords: *lean management, screen-printing, activity analysis, adjustments, performance, health.*

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KEEPING UP WITH THE AGING POPULATION: ADAPTING USER INTERFACES FOR THE ELDERLY

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Abstract

The population is aging, with the percentage of individuals over 60 growing by 3% per year. However, this age group is frequently disregarded in application design. An aging workforce poses challenges for Industry 4.0, focusing on ergonomic, cognitive, and physical aspects. Older users are typically ready to embrace new technology, but fear of making mistakes and an unadjusted user interface slow their progress. This research addresses ergonomic features of user interface design to guarantee that the elderly have equal access to technology and digital services as the younger generation. Using the literature review method, we discovered that the challenges experienced by the elderly are connected to visual, psychomotor, and cognitive limitations. Furthermore, the persona method and user stories were utilized to establish the target population's application-specific requirements. The goal of this study is to give guidelines for adjusting user interfaces, with an emphasis on enhancing the user experience for the elderly. The user interface was designed following elderly-friendly standards, and presented through a mobile application prototype for healthcare services. The findings of this study revealed which usability elements are crucial for the aging population. Adapting applications to the elderly is an essential step towards a more inclusive and fair society which contributes to the quality of life of the elderly population.

Keywords: *elderly, ergonomics of user interface, usability, application design, inclusive society.*

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INFLUENCE OF TYPOGRAPHY AND COLOUR ON RECOGNITION OF INFORMATION

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Abstract

Visual communication has become an integral part of our lives, as we encounter it at every turn in the environment around us. Information must be hence designed in a way that it is found and understood as quickly as possible. Therefore, we studied the effect of typography and colour on the recognition and perception of information in visual media. We prepared 20 samplers on which we applied four five-letter Slovenian words. The samplers were divided into four sections, i.e. words with different typefaces, words coloured in a random colour, words where only one word was coloured in a fully saturated hue, and finally, a sampler where the type size of one of the four words shown was enlarged by a factor of two. Thirty-five participants took part in the experiment, which was conducted using an eye-tracker device (Tobii Fusion Pro). The participants looked at different samplers for a short period of time and then had to answer which word they saw first. The frequency of words answered were used to analyse the results. The statistical analysis of the results showed that the type size had the greatest influence on the recognition of information.

Keywords: *colour, information, recognition, type size, typography*

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COGNITIVE ANALYSIS OF PEDESTRIAN FLOW REGULATION IN UNIVERSITY SECURITY GUARDS: A LOW COST PROTOTYPE FOR REGISTRATION

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Abstract

Background: Security guards play a vital role in ensuring security and order, guarding facilities, and controlling access. Mental workload is a critical variable that influences their performance and well-being, and poor working conditions contribute to mental fatigue and possible errors. Objective: The study aimed to investigate the mental workload of security guards at a university, employing a systemic ergonomics approach and to develop a prototype application that can effectively reduce mental overload, a significant issue in the security guard profession. Materials and methods: The study employed a comprehensive mixed approach. We described the work system using Smith & Carayon's model, characterized tasks through hierarchical task analysis [HTA], assessed mental workload using the NASA -TLX, and identified errors using the SHERPA method. Results: It was found that the main tasks, such as identity verification, verification of backpack contents, and the decision to enter the campus, present errors that affect performance. The dimensions that generated the greatest mental overload were time demand, mental demand, and frustration. In general, the security guards perceive medium-high levels of mental workload. Conclusions: Identity control tasks for persons entering and leaving the university raise the mental overload being a significant barrier due to constant checks in a short time, which increases mental stress and the possibility of errors. In addition, the absence of advanced technological systems requires verification to be done manually, increasing the workload. We proposed the development of a low-cost application for mobile phones that scans barcodes to enhance efficiency in managing pedestrian flow.

Keywords: *cognitive analysis, ergonomics, security guard, mental workload, systems approach.*

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INFLUENCE OF AGE AND PALM SURFACE AREA ON SECONDARY TASK PERFORMANCE IN A DRIVING SIMULATOR

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Abstract

Gesture control allows for reduced glance interaction when controlling secondary functions, such as entertainment systems in cars. Currently feedback for gesture control is mainly audio-visual, although these senses are highly used during human-machine interaction in cars. Ultrasound based mid-air haptics make it possible to use the haptic sense in the hands giving the user feedback for gesture control. To date there has been a lack of research investigating the influence of age on performance during dual task applications, such as driving a car and controlling secondary functions with gesture control and mid-air haptics. The following test subjects study investigates ways to introduce a characteristic feedback point on a virtual slider which differs from the adjacent points. This is either by changing the intensity or distance to adjacent points. The time to find the point and the slider value set by the participant was saved. Participants gave ratings for each of the nine parameter sets by questions about the usability and the user experience questionnaire. Additionally, the influence of the participant's palm surface area on rating of mid-air haptics was investigated. The study consisted of two age groups; 30 younger participants with an average age of 31.0 years and 31 older participants with an average age of 63.0 years. Three of the older participants reported to not feel the mid-air haptics of any parameter set. Significant differences were found between the age groups in subjective and objective terms. Further research will evaluate the findings in a more immersive static driving simulator.

Keywords: *human-machine interaction, ultrasound; mid-air haptics, haptic slider, universal design.*

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USE OF ARTIFICIAL INTELLIGENCE (AI) IN THE WORKPLACE ERGONOMICS OF INDUSTRY 5.0

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Abstract

Industry 5.0 emphasizes human-centricity, sustainability, and resilience as its core characteristics, with a focus on developing socio-technical systems that enhance human health, safety, and well-being while fostering sustainable societal practices. The human-centric perspective places significant importance on human factors and ergonomics, aiming to align technological advancements with the needs and capabilities of individuals. In this context, artificial intelligence (AI) emerges as a transformative tool for advancing human factors and ergonomics by optimizing workplace conditions and supporting human-centered design principles. This paper conducts a literature review to explore the applications and potential of AI in addressing human factors and ergonomics challenges, providing insights into its role in shaping the future of human-centric systems within Industry 5.0

Keywords: *ergonomics, human factors, Industry 5.0, organization, management, optimization, human-centered, manufacturing, workplace*

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EXPOSURE TO HAND-ARM VIBRATION (HAV) IN FORESTRY: AN EMPIRICAL REVIEW

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Abstract

Exposure to hand-arm vibration (HAV) in forestry is almost exclusively related to operating a chainsaw. The problematization of vibration arose with the mass adoption of chainsaws for forestry work in the 1960s. Terms like "vibration white finger" refer to symptoms and conditions caused by exposure to HAV classified today under Raynaud's syndrome. To battle health issues caused by HAV, exposure calculation methods were established, and multiple legislative measures were issued. Although the ergonomics and overall safety of chainsaws improved immensely since the 1960s, exposure to chainsaw-induced HAV remains a relevant factor for the occupational health of chainsaw operators. This paper aims to compile the latest studies on this topic and present it concerning known influential factors and protective measures.

Keywords: *forestry, vibration exposure, chainsaw, HAV.*

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THE NEW TECHNICAL REGULATION ON ACOUSTICS IN BUILDINGS IN CROATIA

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Abstract

Acoustics in buildings is a branch of technical regulations that has been somewhat neglected and overlooked in Croatia for a long period of time, and the corresponding requirements have not been properly regulated ever since Croatia was recognized as an independent country. The relevant experts resorted to using the standards taken over from the previous period of Croatian history in which the country existed as a part of Yugoslavia. Over time, these standards have been officially withdrawn or have fallen out of use, but some of them have continued to be used as no other regulation documents were available. Several unsuccessful attempts have been made to replace these old standards by creating an appropriate document to succeed them. This paper presents the current endeavours to develop the new Technical Regulation on Acoustics in Buildings in Croatia, undertaken by experts from all the relevant fields of expertise, backed up by representatives of relevant professional and governmental institutions. The purpose of this technical regulation is to provide technical requirements that concern sound insulation in buildings for all their critical parts, requirements on the levels of internal noise generated by outdoor and indoor sources, and the requirements on room acoustics, either as a prerequisite for achieving optimal acoustic conditions or simply as a measure for reducing the noise caused by excessive reverberance. The motivation for developing this document is presented, as well as its scope and content. The document is currently undergoing final stages of approval and is expected to be released by the end of 2024.

Keywords: *acoustics in buildings, technical regulation, room acoustics, sound insulation, noise, service equipment noise.*

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ASSESSMENT AND COMPARISON OF WORKING POSTURES OF ELECTRICIANS IN ELECTRICITY DISTRIBUTION USING THE REBA METHOD

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Abstract

For every workplace, it is important to identify the hazards, harm and effort to which the worker is exposed and to carry out an appropriate risk assessment. One of the major risks in the work of an electrician in electricity distribution is working at a height of more than 3 metres. The work of an electrician at height is carried out with personal protective equipment and, if possible, with additional equipment such as a bucket lorry (articulated telescopic platform). Due to the increasing importance of health and safety in the workplace, workload analysis methods have been developed to identify unfavourable working postures. Working postures affect the comfort and productivity of the work. In this study, a posture assessment is carried out using the ergonomic Rapid Entire Body Assessment (REBA) method for the work of electricians at height. In the first case studied, the electrician does not use a bucket lorry for work at height, while in the second case, a bucket lorry is used. The field measurements and the data acquisition of the working postures during the execution of the electrician's work task at height were carried out using a drone with a video camera. The recorded postures were analysed with the software package ErgoFellow 3.0 using the REBA tool. The REBA values obtained show that the work of an electrician at height without using a bucket lorry is significantly more demanding and risky.

Keywords: *electrician, working postures, REBA method, program package ErgoFellow 3.0.*

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PROSPECTIVE EFFECTS OF ARTIFICIAL INTELLIGENCE ON BURNOUT SYNDROME: REDUCING RISKS AND ENHANCING PSYCHOLOGICAL WELL-BEING ON HEALTHCARE

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Abstract

Burnout is a major global issue in healthcare that have a negative influence on patient care and health quality. As predicted by researchers, robots, algorithms, smart technology, and artificial intelligence (STARA) account for one-third of all employment currently held by humans. A STARA awareness measures how much employees think emerging technology could replace their occupations.
Methods: a cross sectional study used The Maslach Burnout Inventory, which is a psychological diagnostic tool with 22 items related to professional burnout, and STARA awareness to calculate prevalence of artificial intelligence and burnout syndrome and to determine whether the use of AI reduces or increases the impact of burnout syndrome risks on healthcare practitioners.
Result: The average mean rating for burnout dimensions had been as follows: 28.65 ± 14.89 SD for Emotional Exhaustion (EE), 9.89 ± 6.83 SD for Depersonalization (DP), and 39.72 ± 8.71 SD for Personal accomplishment (PA). The highest mean of participants, agreement recorded for the item "I am personally worried about my future in my industry due to AI replacing employees" 1.36 ± 1.06, the total mean was 1.22 ± 0.13 at level Disagree. Increased STARA awareness had a positive association with burnout.
Conclusion: Burnout is linked to signs of personal and professional burden that is a prevalent issue among physicians. Suggestions for bettering working circumstances are made. Being aware of AI patterns of use and characteristics is an essential step to reduce the impact of burnout. Further investigation is required to determine the causes and establish measures for intervention.

Keywords: *artificial intelligence, STARA, technology, burnout syndrome, healthcare.*

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CLEAN/DIRTY PATHWAYS IN HOSPITALS: MODELING AND EFFECTIVENESS OF THE USE OF A VIRTUAL REALITY X MOCKUP

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Abstract

The effectiveness of using digital simulations in the hospital field has been demonstrated in the design of facilities and staff training. Models such as BIM+VR [1] show how parametric design enables rapid updates and optimizations of structures using virtual reality environments. Through mockups of real hospitals, disasters have been simulated to prepare staff for such events, significantly improving the understanding of procedures to be implemented and the engagement of participants. Another critical issue of the hospital environment is the exposure of patients, staff, and the public to infectious agents due to a healthcare system failure (e.g. ventilation, water or decontamination incidents) or the wrong design and use of the clean/dirty pathways to prevent cross-contamination. Considering the latter aspect, introducing virtual reality mockups in the planning and management of clean/dirty pathways can help reduce contamination risks through the optimized design of spaces and operational flows from different perspectives (patients, staff, and the public). This article describes the construction method of the virtual mockups and the preliminary experiment results, providing evidence of VR's potential to enhance understanding and adherence to best practices in operational procedures within healthcare facilities. The experiment involved participants who were asked to walk through a clean/dirty pathway, having different characteristics, later comparing their behavior (errors and crossing time) through scenarios that simulate typical operational conditions encountered by healthcare workers. The preliminary results show that horizontal signage significantly reduces the time patients take to reach different hospital areas compared to vertical signage ($p < 0.028$).

Keywords: *Cross-contamination, pathways, virtual reality, digital hospital.*

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COGNITIVE ERGONOMIC-DRIVEN TECHNOLOGY: A PATHWAY TO IMPROVED MENTAL WORKLOAD, BODY POSTURE, AND WORK PERFORMANCE OF AGEING WORKERS IN OFFICE SETTING

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Abstract

Ageing may reduce cognitive function, impacting thinking, reasoning, and memory. One of the potential solutions to address this issue is by utilizing Cognitive-Driven Technology (CEDT). The objective of this study is to investigate the impact of cognitive ergonomic-driven technology on the perceived mental workload, working posture, and task performance of ageing workers. Eight ageing workers were instructed to perform two types of tasks (arithmetic and typing) in two segments (i.e., Segment A (baseline) and Segment B (consisting of CEDT interventions). The accuracy and efficiency of tasks from both segments were evaluated. Mental workload measures (NASA-TLX and Heart rate) and body posture were recorded during the task execution. The recordings were utilized in developing the scenario in a design software, which then further analyzed the Rapid Upper Limb Assessment (RULA) score. One of the crucial findings has been achieved, which result of the correlation analysis shows that in segment B, there was a strong and significant negative correlation between the RULA score and task performance score ($r=-0.781$, $p=0.022$). This means that as the RULA score decreases (indicating better working posture), the task performance improves. These findings emphasize CEDT's role in maintaining good posture for performance.

Keywords: *mental workload, body posture, work performance, ageing, office setting.*

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THE DEVELOPMENT OF AN AUTO-SHUT-OFF SLEEP-INDUCING BED

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Abstract

Sleep is an indispensable human need for survival, development and healthy living. Non-communicable diseases such as hypertension and cardiovascular problems which are resultant effects of lack of good sleep are major mortality factor in Nigeria. Despite several research attempts at developing technologies and methods to help induce and aid sleep, sleep problems persist. This study aimed to develop a sleep-inducing bed to reduce sleep problems among Nigerian adults. An auto-shut-off sleep-inducing bed of "1898 x 1099.20 x 609.6 mm" was developed using a reciprocating motion mechanism centered on an eccentric shaft application. A self-developed questionnaire, direct observation, fuzzy logic, and SPSS were used for data analysis on a total of 234 participants who were sampled for the study. Twenty seven out of the 234 participated in the testing of the bed while 207 responded to the study questionnaire. The study described sleep quality as a "function of environmental factors (Ef) or sleep disorder (Sd)". An average of 20.37 minutes was achieved as the sleep onset latency (SOL) with the bed. The study revealed critical negative and positive relationships among age, nature of work, health status, body height, marriage, the timing of sleep and hobbies to sleep quality. The developed smart bed is safe, simple to use, and a sleep companion. The bed was able to achieve a 75% SOL of less than 20 minutes when it was tested, and the study was also able to uphold the mathematical description of sleep quality as a function of environmental factors or sleep disorders.

Keywords: *sleep, sleep-quality, non-communicable-diseases, reciprocating-motion, sleeplessness.*

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FORECASTING THE IMPACT OF INDISCIPLINE AMONG CADETS-SAILORS ON MARITIME SAFETY AND PROACTIVE WAYS OF ITS CORRECTION

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Abstract

The safety of shipping is considered everywhere through the prism of the influence of the human factor on decision-making by the Master of the ship. What corresponds to the matching/unmatching of the "person - procedures" blocks of the SHELL ICAO model and, accordingly, in the model of the octagon proposed by the authors, where the matching/ unmatching of the blocks is established, on the one hand, «captain - crew - cross-cultural factors», and on the other hand, «practice - technologies, procedures, rules, etc.»
Taking into account the experience of ICAO, an extended list of twenty-one characteristic features of indiscipline was formed, which allows for a more complete and comprehensive study of the mentioned phenomenon in the process of training young sailors. We will consider that indiscipline is a deliberate disregard or improper fulfillment of the established norms of activity / behavior in a specific society, professional or educational.
Taking into account the statistics of accidents and disasters, each characteristic feature of indiscipline in the educational process is matched with the interpretation of its manifestation in the process of professional activity on the ship. Examples of real accidents and disasters that occurred as a result of the manifestation of a specific trait of indiscipline are given.
Based on the well-known Latin proverb "forewarned, therefore armed" and taking into account the experience of research into the dangers of air traffic controllers' mistakes, it is proposed to actively correct the indiscipline of young sailors by teaching them to distinguish, remember, and therefore prevent them. What happens due to the construction of individual and group systems of advantages (rankings) on the set of traits of indiscipline. Preference systems are one of the components of the influence of the human factor on decision-making, they are used to further solve the multi-criteria tasks of determining the integrative assessment of indiscipline of each cadet-sailor, establishing "compromises" for the degrees of expressiveness of the studied features of indiscipline, as well as identifying group deformations in the attitude towards it.

Keywords: *safety of shipping, human factors, indiscipline, accident impact prediction, proactive correction.*

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IMPACT OF A POSITIVE WORK ENVIRONMENT ON MUSCULOSKELETAL COMPLAINTS BY ARTISANAL WEAVERS IN TUNISIA

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Abstract

Aims: The objective is to assess the biomechanical, organisational and psychological constraints and associated risks of musculoskeletal disorders (MSDs) among artisanal weavers. Participants and methodology: The initial phase entailed the collection of data concerning general health and the evaluation of organisational and psychosocial constraints within the workplace. The subsequent phase comprised a semi-quantitative analysis of biomechanical constraints, based on video recordings from five weaving workshops. Results: The total number of weavers included in the study was 20, with an average age of 61.33 ± 5.82 years. The average tenure was 38.1 ± 11.9 years. The data revealed that 30% of the time spent working by artisan weavers was spent in a shoulder flexion or abduction posture, with a variability of 54.1%. It was observed that 12.6% of their working time was spent in a visible state of adduction or rotation, with a variability of 22.3%. The analysis of wrist and hand movements revealed that 39.4% of the work time was spent in extension >30°, with a variability of 53.7%. The data revealed that 53.7% of the working time was spent on digital gripping with a few fingers, with a variability of 53.2%. Conclusion: Despite the repetitive and highly variable nature of the movements, none of the weavers reported any musculoskeletal complaints or discomfort in the previous 12 months. These findings indicate that psychosocial and organisational aspects should be taken into account to ensure effective prevention of work-related musculoskeletal disorders in other industries.

Keywords: *horizontal loom weavers, ERGOROM questionnaire, musculoskeletal disorders, organizational constraints, psychosocial constraints, biomechanical constraints.*

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AUTOMATION POTENTIAL IN THE WORKFLOW OF A SCRUB NURSE

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Abstract

One of the heavily burdened actors in the operating theatre is the scrub nurse who is responsible for the organized and orderly workflow in the operating theatre. One of the main tasks of the scrub nurse is to perform quick and appropriate instrumentation because fast and proactive instrumentation is crucial for the success of the operation. The actual deficiency of specialist staff in the healthcare sector is motivating the automation of repetitive tasks and simple work steps in order to relieve staff in the future and free up capacity for complex and important activities. A robotic assistance system appears to be a suitable solution for many of these challenges. The vision is to develop advanced assistance systems for the handling of instruments in future surgical procedures. In this work, surgery of the carpal tunnel was chosen as an example task. The focus lied on the type and scope of the individual working steps. The analysis was carried out by video analyses and by observing corresponding surgical procedures. Based on the results of the analysis, potentials for improving the workflow were derived and requirements for a robotic assistance system were defined.

Keywords: *workflow, human-machine interaction, ergonomics, robotic assistance system, automation, robot-assisted surgery, scrub nurse.*

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THE COVID-19 CRISIS AND MEDICAL STUDENTS' RESISTANCE TO RETURN TO THE CONVENTIONAL EDUCATION SYSTEM

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Abstract

The lasting pandemic-induced human factors influencing the cognitive sphere of medical students resulted in difficulties in study continuation after the pandemic expressed in stress, anxiety, and slow psychological health recovery. The research aimed to find out the impact of Covid-19 on resisting a return to the conventional education system. A total of 53 medical students completed the Likert scale questionnaire, SPSS software version 29.0 was used to analyze results. The majority of respondents (37; 69.8%) were female and in their fifth year of medical education (31; 58.5%). A considerable proportion experienced heightened stress and anxiety due to the pandemic (30; 56.6%). Statistical analyses showed a significant negative correlation between pandemic-induced stress and anxiety levels and the likelihood of mental health returning to its pre-pandemic state ($r = -.539$, $p < 0.01$). The transition to virtual learning platforms posed challenges, most students facing difficulties in concentrating on their studies (28; 52.9%), expressed concerns about reduced clinical experiences affecting their confidence in medical skills (40; 75.5%), and future clinical competence (23; 43.4%). There was a significant negative correlation between pandemic-induced stress and anxiety levels and academic performance ($r = -0.358$, $p = 0.009$).
Challenges with virtual learning platforms and reduced clinical experiences were notable stressors resisting the return to the conventional education system for medical students due to the lasting impact of the pandemic.

Keywords: *Covid-19 crisis, mental health, academic performance, medical students, virtual learning.*

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EXAMINING HUMAN FACTORS IN TRAFFIC ACCIDENTS: FOCUS ON DRIVER FATIGUE

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Abstract

Traffic accidents are a major road safety concern, with human factors, particularly driver fatigue factors, playing a significant role. Driver fatigue is often linked to reduced alertness, slower reaction times, and impaired decision-making. This study focuses on analysis of driver fatigue factors, on an example of the road traffic accident at a section of state road D102 in Croatia. Using the International Road Assessment Programme (iRAP) methodology, the research aims to eliminate road infrastructure as a primary cause of accidents, placing greater focus on human errors produced by driver fatigue. The study also explores how fatigue detection methods can be used to identify human factors contributing to accidents, guiding more effective prevention strategies. A key case study examines a crash involving a young driver that occurred in the early morning hours. The absence of evidence of braking, the youth of the driver, a flat part of road with a monotonous environment and the timing of the accident strongly indicate fatigue as the primary cause. Additionally, the study evaluates the potential safety benefits of reducing speed limits and removing hazardous roadside objects, such as trees and large rocks, to improve road safety. These changes are predicted to reduce the likelihood of fatigue-related incidents, as well as the consequences of traffic accidents caused by fatigue. The study concludes that road safety improvements and other improvements based on scientific analysis of human-factors can effectively reduce traffic accidents caused by driver fatigue.

Keywords: *driver fatigue, road traffic accidents, human factors, irap methodology, road safety improvement.*

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ALIZA SUPPORT CHAIR: AN ERGONOMICAL CHAIR TO REDUCE PHYSICAL DISCOMFORT

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Abstract

Physical activities in daily life often result in the development of musculoskeletal discomfort, which hinders performance and reduces quality of life. The study aimed to develop a to develop a prototype chair based on ergonomic principles and pressure points to reduce physical discomfort among athletes following sporting activities. A descriptive and comparative study used a user-centred design approach. The study had a first stage of development of the prototype of the chair, developing an idea, sketching, typologies, and low-fidelity prototypes until finally reaching a prototype for testing made in wood. User-centred interviews were used. In the second part, nine people were surveyed to indicate their level of discomfort through the Borg scale after using the chair and give their opinion through an interview. A wooden chair was proposed based on the ergonomic concept of comfort angles and body pressure points in the back and seats. The results showed a significant reduction of discomfort ($p<0.05$) with favourable opinions and conclusions for improving the design. A prototype of a wooden chair with support based on the chameleon concept was developed using a user-centred approach. The chair demonstrated a reduction in physical discomfort for the participants. The prototype also proposed usage times and design improvements.

Keywords: *ergonomics, chair, discomfort, musculoskeletal disorder, design.*

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OPTIMIZING OFFICE ENVIRONMENT: THE ROLE OF HUMAN FACTORS AND HYBRID WORK ENVIRONMENTS FOR EFFECTIVE DESIGN

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Abstract

All companies are facing a transformation and several important and complicated decisions after the pandemic time. When starting a new office environment project, it is important to analyse company goals and factors that are important for employees to ensure an effective work environment. Despite many researches about hybrid work arrangement, office environment and human factors, it is unclear what factors are the most crucial for service oriented organisations. Study objective is to investigate optimization possibilities for the office environment for efficient utilization of office space, improvement of employee satisfaction, to improve efficiency and utilization of hybrid working set up in service organization. Case study explores what are the main human factors impacting efficient hybrid work arrangement in office and how to improve office to maximise potential of the employees. Empirical refinement and validation by using interviews for 90 employees and a survey of 207 employees were used to pilot the assumptions. The main results from interviews and surveys include an analysis of organizational goals, suggestions for a new office setup, validation of hybrid workplace arrangements, factors affecting employees' willingness to work in the office and impact effectiveness of the workforce. To keep employees of the organization efficient, boost employee satisfaction and presence in the office, benchmark, interviews and employee survey was used. Furthermore, as employee expectations change and there is a high competition in the labor market for talents, an employee-centric approach becomes crucial. The authors conclude that comprehensive survey, in combination with a human factors approach, is a good solution to identify, analyse and deliver on the employee and company goals, improving efficiency in organization.

Keywords: *office, improvement, efficiency, human factor, effective design.*

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NEW SPACE TRANSFORMATION LAYOUT: PRIMARY STUDENT'S INTERACTION IN A DEVELOPING COUNTRY'S CLASSROOM ENVIRONMENT

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Abstract

A conducive learning environment is essential for children. Therefore, classroom space needs to be appropriately designed to create a suitable and dynamic environment. This indirectly impacts children's learning outcomes and their interest in attending school. Previous statements and research on Active Learning Classrooms (ALC) and Task-Based Learning (TBL) have shown positive effects on interaction and connection between students and teachers when applied in the classroom. These studies also demonstrate the correlation between classroom users and furniture; space is integral to both. In many Asian countries, children typically spend two-thirds of their time in the classroom when starting school. The educational methods in some of these countries still rely on classroom designs centered around the teacher. This is viewed as a traditional classroom layout model based on various factors, such as economics, perception, and architecture, which these classrooms still adhere to. This study proposes an appropriate classroom layout model and suggests directives for classroom furniture that can be applied to current elementary school classroom models in Vietnam.

Keywords: *interior design, active learning environment, student-centered learning, team-based classroom, classroom furniture.*

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QUANTITATIVE ASSESSMENT OF FACEMASK PERIPHERAL LEAKAGE

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Abstract

Background: Peripheral air leakage affects the ability of a facemask to protect a wearer from exposure to airborne contaminants. Leakage occurs when air bypasses a mask's filter material and enters or exits the mask through gaps between the mask and the face. A wearer creates a negative pressure inside the mask during inhalation and a positive pressure during exhalation. These pressure differentials draw air in, or push air out of the mask reducing the effectiveness of a facemask.
Methods: An air-pressure measurement chamber was developed to simplify mask air leakage assessments. Changes in air pressure and airflow were recorded using a differential manometer and a digital thermoanemometer. Differences between mask airflow and airflow through an open configuration (control) determined the airflow deficit driving peripheral leakage. Four facemask types were tested including a surgical mask, a covid mask, a cotton mask and a N95 mask.
Results: The data showed leakage similarities among the four mask types tested. The surgical mask exhibited 50% leakage. The covid mask exhibited 67% leakage while the cotton mask exhibited 63%. The N95 mask exhibited a leakage of 72%.
Conclusions: The results of this study confirm previous studies that show high levels of peripheral leakage associated with most facemasks currently in use. The assessment method described in this study provides a new and simplified method to determine such leakages.

Keywords: *waste collection, metabolic consumption, postural load, perceived effort, ergonomic design.*

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ASSESSING WORKLOAD IN URBAN SOLID WASTE COLLECTION: A CASE STUDY FROM MEDELLÍN, COLOMBIA

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Abstract

Urban solid waste collection poses significant ergonomic risks, particularly in developing countries. This study evaluated the workload of waste collection crews in Medellín, Colombia, focusing on metabolic consumption, postural load, and perceived effort. Three crews using different waste collection methods (bins and bags, ground collection, and mobile containers) were selected, each consisting of one driver and two collectors. Video recordings were used to define work cycles and estimate metabolic consumption following ISO 8996:2021. Postural load was assessed using the OWAS method, while the BORG-10 scale was applied to measure perceived effort among 21 collectors. The results revealed variability in workload depending on the collection method, though all fell within the moderate activity range (150–350 kcal/h). Crew 2 showed the highest energy expenditure (263.8 kcal/h) and postural load, with 60% of postures in OWAS category 4. In contrast, Crew 3, handling mobile containers, had the lowest energy and postural demands. A significant portion of workers (71%) rated the tasks as highly demanding on the Borg-10 scale. The findings indicate that workload varies based on the collection method, with the most critical case involving crews that collect waste from the ground. The preferred scenario involves the use of mobile containers and container-handling trucks. Measures such as rotating crews and employing back exoskeletons could help mitigate musculoskeletal risks.

Keywords: *waste collection, metabolic consumption, postural load, perceived effort, ergonomic design.*

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DEVELOPMENT OF FUZZY METHOD OF AIR TRAFFIC CONTROL STUDENTS' ATTITUDE TOWARD RISK OF FLIGHT LEVEL NORMS VIOLATION DETERMINATION

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Abstract

ICAO constantly tracks human factor negative influence on flight safety. It highlights insufficient development of "mental forecasting perks" shown by "front line" operators like crew members and air traffic controllers. This flaw is targeted by research of human factors components influence over decision making that helps to explain all their interaction. This is a part of current ICAO flight safety paradigm, namely personnel "attitude toward quality or safety issues". The effect plays role because participation in such research itself helps "front line" operators including air traffic controllers to develop proactive perks of memorizing and thus preventing hazards in their professional activities. Grounding on ICAO risk severity categories (catastrophic, hazardous, major, minor, negligible) it is possible to develop fuzzy models of air traffic control students risk attitude. Properly applied methodology allows taking into account and researching their attitude toward flight level norms violations. This is used to resolve IAO risk triangle with such tangible and well understood indexes and metrics as distance between aircraft under control.
Generalized group opinion about risk severity categories can be considered as absolute value of fuzzy membership functions. Grounding on their values the method of air traffic controllers risk attitude estimation is suggested. The results correlate well with the main decision-making dominants values. These values are referring to decision making peculiarities received through research of success achievement or failure prevention motivation.

Keywords: *flight safety, human factors, flight level norms violation, fuzzy models, attitude toward risk, air traffic control students.*

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Review of the
9th International Ergonomics Conference - ERGONOMICS 2022

Dear colleagues,

Croatian Ergonomics Society (CrES) has been organising conferences in the series “Ergonomics” since 2001 to promote ergonomics and exchange knowledge and experience with the scientific and professional community from Croatia and the world. The Conference traditionally brings together enthusiasts, experts and scientists from Croatia and from all over the world, who present their state-of-art research findings and exchange professional ideas, as well as their practical experiences.

The 9th International Ergonomics Conference - ERGONOMICS 2022 was held from 7-10 December 2022 at the University Campus Borongaj "ZUK Borongaj", in Zagreb, the capital of Croatia. The Conference was organised by several faculties of the University of Zagreb:

- FPZ (Faculty of Transport and Traffic Sciences)
- FSB (Faculty of Mechanical Engineering and Naval Architecture)
- TTF (Faculty of Textile Technology)

Furthermore, the Conference has been endorsed by:

- IEA (International Ergonomics Association)
- FEES (Federation of European Ergonomics Societies)
- ASC (Acoustical Society of Croatia)

The Conference program included presentations of papers from the following groups of topics (not limited to):

- Aesthetics and Ergonomics
- Biomechanics and Modelling in Ergonomics
- Cognitive Ergonomics
- Education and Trainings in Work Safety and Ergonomics
- Ergonomics for People with Disabilities and Aging Population
- Ergonomics in Product and Process Design
- Ergonomic Regulations, Standards and Guidelines Healthcare Ergonomics
- Physical Ergonomics and Human Factors
- Human Comfort
- Safety and Risk Ergonomics
- Psychoacoustic Ergonomics
- Social and Occupational Ergonomics
- Traffic and Transport Ergonomics

The Organizing Committee (OC) of the ERGONOMICS 2020 Conference, chaired by CrES president assoc. prof. Ivana Salopek Čubrić PhD, received more than 50 contributions within a diverse range of conference topics. After the review process, the International Scientific Committee accepted 47 abstracts for presentation. Croatian Ergonomics Society published Book of abstracts - 9th International Ergonomics Conference – Ergonomics 2022 (Print ISSN: 2757-0517; Electronic ISSN: 2757-0525) with the accepted, peer-reviewed abstracts in English.

65 registered people participated in the Conference (both live and online). The participants came from Australia, Bosnia and Herzegovina, Brazil, France, Germany, Greece, Croatia, South Korea, Hungary, India, Italy, Israel, Japan, Malaysia, Poland, Portugal, Romania, Russia, USA, Slovakia, Slovenia and Ukraine.

The conference was organised as a hybrid event with the following presentation options:

- live, on-site oral presentation
- real-time on-line oral presentation
- pre-recorded oral presentation
- poster presentation

The Conference opening ceremony started with an invited lecture by prof. Jose Orlando Gomes (IEA President) who also addressed the participants with a few words of welcome.

The authors of the accepted abstracts were invited to contribute with full papers. After the peer review process was done by the international and Croatian reviewers, 38 full papers were accepted for publication in the post-conference proceedings. All the papers will be published by Springer Nature P. Co. in "Proceedings of the 9th International Ergonomics Conference - ERGONOMICS 2022" indexed in Scopus, in the series „Lecture Notes in Networks and Systems", ISSN 2367-3370 (available online and print).

The ninth edition of the Conference provided a great opportunity for all the participants and stakeholders from Croatia and abroad to contribute to the advances in ergonomics, share their knowledge and experiences, and expand their interdisciplinary research network. We believe that our next 10th anniversary conference Ergonomics 2024 will be a new opportunity for a successful promotion of ergonomics. We expect it will gather an even greater number of participants in this interesting and relevant research area which opens strong interdisciplinary perspectives for scientific cooperation.

Asst. Prof. Jasna Leder Horina

CrES President

Journals that support the work of the Croatian Ergonomics Society

Safety: Journal for the safety in the work organization and living environment

Institute of safety research and development

Promet - Traffic&Transportation

The Journal Tehnički glasnik - Technical Journal

Interdisciplinary Description of Complex Systems - INDECS

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