2021

HWWE

Humanizing Work and Work Environment

1-3 December 2021

Dept. of Design
IIT Guwahati, India

ABSTRACT BOOK

Editors:
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IEA
International Ergonomics Association

ACED

Indian Institute of Technology Guwahati

Centre for Ergonomics: User-centered Design and Occupational Wellbeing
Department of Design, Indian Institute of Technology Guwahati, Assam, India

2021

HWWE

Humanizing Work and Work Environment

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Online Mode, Links will be Shared

Schedule

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Day 1 (December 1, 2021)

Inauguration (09:00-9:40)

December 1,2021, **Session 1**, Hall 1

Session	Schedule		Author(s)/Speaker(s)
Session Chair **Prof. Debkumar Chakrabarti** Co-Chair **Prof. Prakash Dhara**	9.40-10.00	**HWWE2021 Inaugural Addresses**	Jose Orlando Gomes
	10.00-10.20		Yushi Fujita
	10.20-10.40		A.K. Ganguli
	10:40-11.00		P.K. Nag
	11:00-11.20		Amitabh De
	11:20-11.40		Amaresh Chakrabarti
	11:40-12.00		Amit Ray
	12.00-12.20		Kathleen Mosier

Lunch Break (12:00-13:00)

December 1, 2021, Parallel Session **2A (13:00-15:00)** (Hall 1)

Session / Session Chair	Schedule	Code	Track	Title	Author(s)/Speaker(s)
Lead lecturer and Session Chair **Prof. Mohammad Muzammil**	13:00	LL-1	**Work and Fatigue**	Assessment of Postural Discomfort in Present and Modified Drilling Methods	Mohammad Muzammil
	13:20	P-42		BRAKING: The Most Strenuous Task of Locomotive Driving	Subir Danda, Soumya Sarkar, Bikash Bepari, Kalyanbrata Saha, Balendra Nath Lahiri
	13:40	P-46		Study of the effect of worker characteristics on maximum acceptable weight of Lift.	Saman Ahmad, Mohammad Muzammil
	14:00	P-72		Modifying the Revised NIOSH Lifting Equation in the Presence of Noise	Nadeem Ahmad, Mohammad Muzammil, Saman Ahmac
	14:20	P-76		Working Posture Evaluation of Bus Drivers - using CMDQ and RULA Technique	Soumyajit Das, Sujit Patra, Subir Danda, Bivash Mallick, Avishek Pandey
	14:40	P-172		Analysis and improvement of working postures in cargo securing process during outbound shipment by using different Ergonomics tools and software	Rahul Bhosale, M Sunil Kumar

December 1, 2021, Parallel Session **2B (13:00-15:00)** (Hall 2)

Session/Session Chair	Schedule	Code	Track	Title	Author(s)/Speaker(s)
Lead lecturer and Session Chair **Prof. Nandita Bhattacharya**	13:00	LL-2	**Musculoskeletal Disorder**	Design elements in educational toys: in usability perspectiv	Nandita Bhattacharrya
	13:20	P-206		A questionnaire analysis for customizing bicycle design based on musculoskeletal disorder discomfort level	Celestin Jerald A, Sasvat Sayee Ram R, Rithani A.S, Kanagasabai Adalarasu
	13:40	P-220		"Incidences of MSDs Prevalent Among the Indigenous Women Involved in Petty Trading in Assam'	Bijoylaxmi Bhuyan, Nandita Bhattacharyya
	14:00	P-286		Assessment of Construction Workers' Musculoskeletal Disorders Risk using Quick Exposure Check tool	Abhishek Trivedi, Parth Patel, Shail Pratap Singh, D A Patel
	14:20	E-36		An ergonomic design of wheel chair for paraplegic persor	Niaz A. Salam and S.A. Binoosh
	14:40	P-219		Musculoskeletal Pain experienced by the Marble Cutting workers in Marble Industries at Kishangarh District, Rajasthan	Vashima Veerkumar, Neerja Jaiswal

December 1, 2021, Parallel Session **2C (13:00-15:00)** (Hall 3)

Session/Session Chair	Schedule	Code	Track	Title	Author(s)/Speaker(s)
Lead lecturer and Session Chair **Dr. L. P Singh**	13:00	LL-3	**Product and Productivity**	Respiratory Symptoms in Brick Kiln Workers: A pre – COVID 19 Study in Indian Unorganized Sector	L. P. Singh
	13:20	P-106		Potential benefits of corporate social responsibility (CSR) in the construction industry	Vigneshkumar Chellappa, Grzegorz Ginda, Urmi Salve
	13:40	P-145		Effects of built environment attributes on work place psychology & productivity	Nivia Jain
	14:00	P-146		Design and Development of Hand Tools for Metal Handicraft in Context of Adoption	Kiran Kumari Mahato, Pratul Chandra Kalita
	14:20	P-147		A Smart Compact Kitchen layout to optimize space utilization	T. Prithvi Kiran, Avantika Verma, Sonal Atreya
	14:40	P-321		Analysis of transplanting activity using Surface electromyography	Parimalam Paramasivam, Padmanabhan, Kaliappan, Nallakurumban Balu, Logeswari Hariharan, Abinaya S

December 1, 2021, Parallel Session **2D (13:00-15:00)** (Hall 4)

Session/Session Chair	Schedule	Code	Track	Title	Author(s)/Speaker(s)
Session Chair **Dr. Keyur Sorathia**	13:00	P-25	**Design Application**	Virtual Reality reducing cognitive load in Travel Planning	Aanchal Krishna, Tushar Amin, Tanmayee Puntambekar
	13:20	P-115		Analysis of Body-Gestures Elucidated through Elicitation Study for Natural Locomotion in Virtual Reality	Priya Ganapathi, Keyur Sorathia
	13:40	P-45		Sound design in cinematic virtual reality: A State-of-the-art review	Hitesh Chaurasia, Manoj Majhi
	14:00	P-313		A user-centered comparison of novelty and typicality in product designs using pictorial and augmented reality (AR) representatior	Rambardhan K, Dhananjay Singh Bisht
	14:20	P-12		An Empirical Study on Cognitive Impartment of Knowledge in Children through Augmented Reality	Sandipan Bhattacharjee, Bhaskar Saha
	14:40	P-189		Learning Indian Classical Dance Forms with the Help of Augmented Reality (AR) Applicatior	Sudakshina Choudhury, Anirban Chowdhury

December 1, 2021, Parallel Session **2E (13:00-15:00)** (Hall 5)					
Session/Session Chair	**Schedule**	**Code**	**Track**	**Title**	**Author(s)/Speaker(s)**
Lead Lecture and Session Chair **Dr. Prabir Mukhopadhyay** and **Dr. Debayan Dhar**	13:00	LL-4	**Design Application and Communication**	Ergonomic Issues in the school environment for enhanced productivity	Prabir Mukhopadhyay
	13:20	P-155		Photography is a Tool of Social Awareness	Bappa Das, Debkumar Chakrabarti
	13:40	P-144		Ergonomic study in information system design of two major railway platforms of India	Jigyasa Patankar, Suyash Krishna, Sangeeta Pandit, Rajat Kamble
	14:00	P-279		Game Addiction and Game Design: A Study based Candy Crush Saga players	Navyashree s, Shivangi Vashisth, Wricha Mishra
	14:20	P-273		Enabling Sign Language Recognition Feature in Video Conferencing	Shuruthi V, Keerthana K, Sudha M, Ibrahim Badhusha U, Vijayalakshmi M, Vignaraj Ananth V
	14:40	P-311		The effects of training with two smartphone games based on Stroop	Shivam Kumar Singh, Dhananjay Singh Bisht
	15:00	E-34		Making the Furniture's Design Inclusive for Obese in HEIs: A Study in Bengalee Females	Sweety Bardhan, Sayantika Saha, Ayana Das, Santanu De, Neepa Banerjee and Shankarashis Mukherjee
December 1, 2021, Parallel Session **2F (13:00-15:00)** (Hall 6)					
Session/Session Chair	**Schedule**	**Code**	**Track**	**Title**	**Author(s)/Speaker(s)**
Lead Lecture and Session Chair **Dr. Parag Vyas**	13:00	LL-15	**Ergonomic Tools and Techniques**	Standard Indian Jewellery Workbench - Applied Ergnomics in the Domain	Parag Vyas
	13:20	P-195		Development of scale for assessing occupational health hazards in post harvest activities (OHHPA scale)	Mira Kalita, Ruplekha Borah, Nandita Bhattacharyya
	13:40	P-262		Fourth Ventricle Compression (CV4) as a Method for Stress Management	Praghosh Chhetri, Tirthankar Ghosh
	14:00	E07		Muscle Activity and Postural Analysis while Using Smartphone	D. Bhanu Priya, Murali Subramaniyam
	14:20	E08		Ergonomic Evaluation of Students Posture on Lathe Machine used in Lab by RULA method	Sudharshan N, Shreyas M, Vinay K B, K S Ravi
	14:40	P-91		Postural Assessment of Indian Floor Tilers' using OWAS, REBA, ERIN and WERA Methods	Manoj gajbhiye, Debamalya Banerjee, Saurav Nandi
	15:00	P-178		Quantification of Neurosignals for Mathematical Model Development of Muscle Fatigue from Inexperinced worke	Rohit Kumar, Rajesh kumar, Parveen Kalra, Ankit Kumar
Tea Break (15:00-15:30)					
December 1, 2021, Parallel Session **3A (15:30 - 17:30)** (Hall 1)					
Session/Session Chair	**Schedule**	**Code**	**Track**	**Title**	**Author(s)/Speaker(s)**
Lead Lecture and Session Chair **Prof. G. Madhan Mohan** and **Dr. Abhishek Srivastava**	15:30	L-13	**Environmental Stressors and Ergonomics**	Ergonomic Framework to Mitigate Physical Risks in Manufacturing Industry	G Madhan Mohan and P Ashok
	15:50	P-32		Digitized Visual Fatigue Detection for Humanizing Digital Work Environments	Prerita Kalra and Vinod Karar
	16:10	P-88		Thermal Performance of Green Roof and Conventional Roof in the warm humid climate of India	Rebecca Varghese, Amalan Kaushik
	16:30	P-221		Evaluating Indoor and Outdoor Thermal Comfort Parameters Affecting Work Environment of Railway Pantry Ca	Md Sarfaraz Alam, Urmi Ravindra Salve
	16:50	P-310		An assessment of seasonal variations on dust exposure for Mine operators of Central India	Nikhil Kulkarni, Harish Barewar, Krunal Lingayat
	17:10	P-57		Role of Design Control Interventions in Ameliorating Hot Stressful Thermal Work Ambience: A Revie	Milap Sharma, N.M. Suri, Suman Kant
December 1, 2021, Parallel Session **3B (15:30 - 17:30)** (Hall 2)					
Session/Session Chair	**Schedule**	**Code**	**Track**	**Title**	**Author(s)/Speaker(s)**
Session Chair **Prof. A. K. Das**	15:30	P-188	**Product and Productivity**	Optimal Design of Customized Ankle Foot Orthosis for Drop Foot Patients	Rohit Kumar, Rajesh kumar, Parveen Kalra, Rajesh Madan
	15:50	P-164		Design, Development and Performance Evaluation of Foot operated Elephant apple Core cutter	Deepanka Saikia, Prakash Kumar Nayak, Kesavan Radhakrishnan, Javed Akhtar Barbhuiya, Sandip Mandal
	16:10	P-174		Multipurpose, Low cost, electricity-free cold storage cum vending cart for vegetable and fruit vendors	Abhishek Singh, Pratul Chandra Kalita, Gurdeep Singh, Raksha Singh
	16:30	P-240		User and market research with proposed concepts for ceiling-fan dust cleaning	Marilyn Supriya Albert, Sudarshan Katti, Arunachalam Muthiah
	16:50	P-301		Impact of select design characteristics in food packaging on consumer behavior: A study on Elderly population in Kolkata	Dr Neepa Banerjee, Dr Sandipan Chatterjee, Dr S Mukherjee
	17:10	P-148		An improved User Interface for enabling Smart access using Low-cost QR based systems	Shaivi Kant, Dr. Sai Prasad Ojha

December 1, 2021, Parallel Session **3C (15:30 - 17:30)** (Hall 3)					
Session/Session Chair	**Schedule**	**Code**	**Track**	**Title**	**Author(s)/Speaker(s)**
Session Chair **Prof. C. K. Pradhan**	15:30	P-149	**Recent Trends and Research in Ergonomics**	Eye tracking to evaluate the Usability of User Interfaces	Moonty Baruah, Nandita Bhattacharyya, Sougata Karmakar, Bighna Nayak
	15:50	P-222		Musculoskeletal Discomfort faced by Interior Design Students during Online Learning	Himani Shah
	16:10	P-238		Impact of work-related factors on musculoskeletal discomfort among the rural housewives in central India	Jaita Mondal, Tirthankar Ghosh
	16:30	P-271		Discomfort experienced by students while attending online classes during the pandemic period	Edison Gundabattini, darius solomon, Preethi S H Darius
	16:50	P-41		Rotating Cylindrical PIN VR Display - An ergonomic approach for VR scripts	Delwyn Remedios, Deepak Mathew, Max Schleser
	17:10	P-11		Ergo-Studio – (An experiential approach to teaching and learning ergonomics.) A case-study on teaching and learning ergonomics in a studio mode	Gourab Kar
December 1, 2021, Parallel Session **3D (15:30-17:30)** (Hall 4)					
Session/Session Chair	**Schedule**	**Code**	**Track**	**Title**	**Author(s)/Speaker(s)**
Lead Lecture and Session Chair **Sheetal M. Gokhale**	15:30	P-314	**Design Application**	Mind's Eye and the Cinematic Lens – An analysis of metaphoric themes and their cinematic adaptation...	Sheetal Gokhale, Ravi Mokashi Punekar, Debapriya Basu
	15:50	P-211		Combined use of selected UX research tools and creation of user persona for design and evaluation of sustainable e-commerce Apps - a case study	Ishika Goswami, Monomoy Goswami
	16:10	P-216		The need of a digital typeface for Assamese script	Bedanta Batchas, Mohammad Shahid
	16:30	P-131		Perception and Continuous Intention of Wearable Fitness Trackers Among Different Age Groups: En Route Towards Health and Fitness	Swati Sarkar, Prof. Debkumar Chakrabarti
	16:50	P-34		Oro White Toothbrush | Design and Conceptualising Dental Caries Detection Method	Bitopan Kalita, Ashish Sharma
	17:10	P-99		Re-learning Puberty: Minimising Period Shaming in Urban Schools	Kavya Kulshreshtha, Saurabh Tewari
December 1, 2021, Parallel Session **3E (15:30-17:30)** (Hall 5)					
Session/Session Chair	**Schedule**	**Code**	**Track**	**Title**	**Author(s)/Speaker(s)**
Lead Lecture and Session Chair **Dr. Bhaskar Saha** and **Prof. Devashish Sen**	15:30	LL-5	**Design Application**	Digital technology and Artistic skill in creative production- Respect of Animation Entertainment platform	Bhaskar Saha
	15:50	P-50		The Impact of Service Quality on Customer Loyalty of Indian E-commerce Industry: The Mediating Role of Customer Satisfaction	Pragati Agarwal, Akansha Verma, Sunita kumari Malhotra, Sanjeev Swami
	16:10	P-5		Design of personal protective wear for disabled people: An improvisation on ergonomics	Surya Bharath, Mohammed Zakriya
	16:30	P-26		Bucky- The study of an Ergonomic Design Intervention for a Bucket carrying task	Sudip Ray, Tanmayee Puntambekar, Shivangee Tilak, Swasti Gautam, Samantha Dimal
	16:50	P-190		Application of Immersive Media to Develop Model Making Skills of Industrial Design Learners	Shakti Banerjee, Anirban Chowdhury, Anmol Srivastava
	17:10	P-210		Exploring Aesthetics of Vastu Shastra; Transformation of Domestic Architectural spaces.	Jency P A, Sonal Atreya
December 1, 2021, Parallel Session **3F (15:30-17:30)** (Hall 6)					
Session/Session Chair	**Schedule**	**Code**	**Track**	**Title**	**Author(s)/Speaker(s)**
Lead Lecture and Session Chair **Dr. Samrat Deb**	15:30	LL-6	**Industrial Ergonomics & Design**	Ocupational health, Work pattern and psychological factors association with accidents occurance among the non-government city bus drivers in Kolkata	Samrat Deb
	15:50	P-47		Traditional cultivation practices of water chestnut in Northeast India: A field survey	Jitesh Singh Chauhan, Hijam Jiten Singh, Sougata Karmakar
	16:10	E06		Dimensions Identified for Physical Ergonomic Analysis in Manufacturing Industries: A Review	Shreyas M, Sudharshan N, Vinay K B, K S Ravi
	16:30	E20		Post Shift Exercises to prevent repetitive strain disorders – A trend that can be started on the Shopfloor	Soumya Prabhat Jati
	16:50	E21		Health Buddy- the new methodology for industrial welllness	Soumya Prabhat Jati
	17:10	E29		Study on the Effectiveness of Manufacturing Execution System (MES) in Manufacturing Industries	Isaac Patturaja G B

Day 2 (December 2, 2021)

December 2,2021, **Plenary Session 1A**, Hall 1

Session	Schedule		Author(s)/Speaker(s)
Session Chair **Prof. Ashish Goswami**	09:00	Plenary Lectures	D. Majumdar
	09:20		Rauf Iqbal
	09:40		Fransisco Dos Santos Rebelo
	10:00		Jhareswar Maiti
	10:20		Netai Chandra Dey
	10:40		K.N. Sen
	11:00		Mohammad Iqbal
	11:20		Asis Goswami

December 2, 2021, **Plenary Session 1B**, Hall 2

Session	Schedule		Author(s)/Speaker(s)
Session Chair **Prof. Somnath Gangopadhyay** and **Dr. Madhusudan Pal**	09:00	Plenary Lectures	Somnath Gangopadhyay
	09:20		Dibakar Sen
	09:40		Shamsul Bahri
	10:00		Anant M. Chakradeo
	10:20		Darius Ganaraj Solomon
	10:40		K.N. Dewangan
	11:00		P Parimalam
	11:20		Madhusudan Pal
	11:40		L.P. Gite

Lunch Break (12:00-13:00)

December 2, 2021, Parallel Session **2A (13:00-15:00)** (Hall 1)

Session/Session Chair		Code	Track	Title	Author(s)/Speaker(s)
Lead Lecture and Session Chair **Dr. Shilpi Bora**	13:00	P-293	**Occupational Health**	Measuring the work stress Level among Nurses During second wav	Shilpi Bora, Pallavi Rani
	13:20	P-277		Ergonomic study on farmers involved with cotton harvesting in Haryana	Neha Neha, Vinu Vimal V J, Sangeeta Pandit
	13:40	P-304		Assessing Lung Functions Status in Male Human Resources engaged in Wood processing Works: Using Surrogate Markers	Tanaya Santra, Surjani Chatterjee, Sandipan Chatterjee, Enakshi Chakraborty, Neepa Banerjee, Baidyanath Pal, Shankarashis Mukherjee
	14:00	P-187		Ergonomic Analysis of Manual Activities among Dairy Farm Workers: A Literature Review	Umesh Gurnani, Sanjay Kumar Singh, Manoj Kumar Sain, M L Meena
	14:20	P-289		Analyzing the hand grip strength of carpenters	Lalit Kumar Sharma, Manoj Kumar Sain, M L Meena
	14:40	P-93		Analysis of Risk Factors (Psychological and Musculoskeletal Disorders) Associated with Smart Phone Usage among Indian Users	P Shrisowmya, Kanagasabai Adalarasu, S Monisha Gowri, T Aravind Krishna

December 2, 2021, Parallel Session **2B (13:00-15:00)** (Hall 2)

Session/Session Chair	Schedule	Code	Track	Title	Author(s)/Speaker(s)
Lead Lecture and Session Chair **Dr. Dilip A Patel**	13:00	LL-7	**Occupational Health & Safety**	Enhancement of Construction Workers' Safety by Controlling Ergonomics Hazards using Internet of Thing (IoT)	Dilip A Patel
	13:20	P-297		Perception Shift Towards (Inter)personal Space: Public Transport ar	Vidushi Jaya, Sanjram Premjit Khanganba
	13:40	P-98		Development of risk assesment system for sewing machine operators	Aastha arora, Manoj Tewari
	14:00	P-141		Identification of Ergonomic Risk factors in Dhokra bell metal handicraft industry of Chhattisgarh, India	Avinash Sahu, Rajat Kamble, Garima Borker, Sangeeta Pandit
	14:20	P-270		A study on the Discomfort Experienced by Foundry Workers and Automation for Reducing the Discomfor	Asif Qureshi, Darius Solomon
	14:40	P-265		Ergonomic Risk Assessment of Office Workers in a Consulting Firm in Kerala	Nikhila Ann Anil, Raghunathan Rajesh
	15:00	P-256		Fishbone Diagram Analysis for Assessing Ergonomic Risks in Onshore Oil Rig Operations	Alex Bernard

December 2, 2021, Parallel Session **2C (13:00-15:00)** (Hall 3)

Session/Session Chair	Schedule	Code	Track	Title	Author(s)/Speaker(s)
Session Chair **Dr. Abhirup Chatterjee**	13:00	P-194	**Cognitive Processing and Response**	Design for cognitive development of kids: A case study of developing interactive toy for small childrer	Piyush Inchurkar, Prakash kumar
	13:20	P-191		Evaluation of Comprehensibility of a Sign by Triangulation method	Sangeeta Bhanja Chaudhuri, Manoj Majhi, Sougata Karmakar
	13:40	P-15		Efficacy of sex differences on the perceptual experience of virtual building Images	Manish Kumar Asthana, Sambath RD, Sharmili Mitra
	14:00	P-43		Impact of writing tools in evolution of Telugu script.	Chakradhar Aalla, Mohammad Shahid
	14:20	P-135		Impact of acoustic distraction and overcrowding on cognitive performance of healthcare professionals	Abhijit Kakati, Amarendra Kumar Das
	14:40	P-263		Experience of Cognitive Workload during In-vehicle Distractions	Sanjram Premjit Khanganba, Sajad Najar
	15:00	E17		Alterations in Cognitive Performance associated with Mobile phone usage in the Eastern and North-Eastern Indian populatior	Sania Sultana

December 2, 2021, Parallel Session **2D (13:00-15:00)** (Hall 4)					
Session/Session Chair	**Schedule**	**Code**	**Track**	**Title**	**Author(s)/Speaker(s)**
Lead Lecture and Session Chair **Dr. Nanki Nath**	13:00	P- 04	**Design application and communication**	Engaging Design Projects: a PBL Framework for the New Normal Communication Design Educatior	Nanki Nath
	13:20	P-127		Participatory Design of a Computer Mouse	Pranjal Protim Borah, Swati Pal, Shimmila Bhowmick, Keyur Sorathia
	13:40	P-173		Digitizing the street vending market	Abhishek Singh, Pratul Chandra Kalita, Gurdeep Singh, Raksha Singh
	14:00	P-212		Understanding the Experiential, Experimental and Spirited aspects of typography	Mohammad Shahid
	14:20	P-215		Effect of A Six Week App Based Ankle Proprioception Training Program on Balance in Fencers	Srinivasa Rao Pachava, Simran S Shakeel
	14:40	P-78		Sustainability: Indian Cultural Heritage through Game Design Concept	Swarnadeep Nath, Bhaskar Saha, Subash Rai, Debkumar Chakrabarti
December 2, 2021, Parallel Session **2E (13:00-15:00)** (Hall 5)					
Session/Session Chair	**Schedule**	**Code**	**Track**	**Title**	**Author(s)/Speaker(s)**
Session Chair **Prof. Ravi Mokashi Punekar**	13:00	P-71	**Design application and communication**	Visual Analysis of Narratives in Naamghars of Assam	Charu Monga, Amrendra Kumar Das
	13:20	E04		Looking at Social and Rural Development from a Multidimensional Perspective	Rituparna Choudhury
	13:40	P-268		The revival of the tribal community by the concept of S.M.A.R.T. Village: A case of Sabar tribe of Jharkhand	Nazish Abid, Mohd Resaal Ansari
	14:00	P-160		A Village in the City	Pulama Oinam, Sonal Atreya
	14:20	P-92		An exploration of animation support to documentary film for better communication	Subash Rai, Swarnadeep Nath, Prof. Debkumar Chakrabarti
	14:40	E37		Assessment of frequency use of controls on self-propelled combine harvesters under dynamic conditior	Prabhakar Shukla
December 2, 2021, Parallel Session **2F (13:00-15:00)** (Hall 6)					
Session/Session Chair	**Schedule**	**Code**	**Track**	**Title**	**Author(s)/Speaker(s)**
Session Chair **Dr. Shakuntala Acharya**	13:00	E13	**Design Application & Ergonomics**	Artistic view of "Smart Bus Terminus" master plan, design and 3D models for implementation in Indian cities	S. Vigneshwaran, Yeddula Bharath Simha Reddy, Praburanganathan
	13:20	P-100		Development of mastectomy bra for breast cancer survivors	Shivangi Sahni, Kritika Dhawan, Manoj Tiwari
	13:40	P-300		Kinetic reciprocation in Landscape Architecture: An exploration of visitation patterns in Dutch Urban Parks	Barsha Amarendra
	14:00	P-118		Comparative visual analysis of brick architecture ornamentations of the Ahom monuments in Sivasagar, Assam, India	Saurav Deori, Utpal Barua
	14:20	P-75		A sustainable approach for the urban sprawl of Kolkata (Circa 1690 2020)	Shilpi Chakraborty, Shiva Ji
Tea Break (15:00-15:30)					
December 2, 2021, Parallel Session **3A (15:30-17:30)** (Hall 1)					
Session/Session Chair	**Schedule**	**Code**	**Track**	**Title**	**Author(s)/Speaker(s)**
Lead Lecture and Session Chair **Dr. Sangeeta Pandit**	15:30	LL-8	**Occupational health**	Ergonomic assessment of hand related occupational pain symptoms among Bagh hand block print artisans of handcrafted textile industry of Madhya Pradesh, India	Sangeeta Pandit
	15:50	P-214		Subject Matter Experts versus OSH Practitioners: Criteria Selection for the Assessment of Pushing and Pulling of Wheeled Equipment in the Workplace	Harikrishnan Tamilselvan, Mohd Nasrull Abdol Rahman
	16:10	P-306		Impact of practicing Bharatnatyam dancing on obesity status in terms of adiposity indices in human resources engaged in white collar jobs: A Study in Bengalee Females	Neepa Banerjee, Tanaya Santra, Sweety Bardhan, Santanu De, Shankarashis Mukherjee
	16:30	P-280		The role of Postural Assessment Techniques in different workplaces A Review	Sanjay Mohan, Ankush Anand, Rajiv Kumar, Mohd Kamal
	16:50	E01		Design of workplace for women worker in fish dressing operation	Vijay V. Awarea, Jagdish K. Khurdalb, R.R. Potdar
	17:10	E16		Facets of Job Satisfaction and Challenging Encounters in Dentistry: A Cross-sectional Study	Garima Pant and Deepa Vinay
December 2, 2021, Parallel Session **3B (15:30-17:30)** (Hall 2)					
Session/Session Chair	**Schedule**	**Code**	**Track**	**Title**	**Author(s)/Speaker(s)**
Lead Lecture and Session Chair **Dr. Swati Pal**	15:30	LL-9	**Ergonomics and Design**	Ergonomics and Design	Swati Pal
	15:50	P-84		Design of Safety Helmet for Construction Workers and Evaluation Using Digital Human Model	Ashish Thulkar, Anirban Chowdhury
	16:10	P-30		Why does an Indian Construction Worker Fail to Wear Personal Protective Equipment (PPE) at Workplace?	Vigneshkumar Chellappa, Urmi Salve
	16:30	P-309		Personalizing Helmet Designing for Bengalee Adolescents receiving Training in Hockey: An Anthropometric Approach	Enakshi Chakraborty, Satabdi Bhattacharjee, Sweety Bardhan, Ayan Chatterjee, Neepa Banerjee, Shankarashis Mukherjee
	16:50	P-318		OSH risk perception of safety managers and scope for ergonomics design interventions in Floating Solar Pho-tovoltaic project	Abhijit Sen, Sougata Karmakar
	17:10	P-229		Fatigue analysis of recreational road cyclist in terms of blood lactate concentration and nutritional intake	Ekta Kapri. Manju Mehta, iran Singh

December 2, 2021, Parallel Session **3C (15:30-17:30)** (Hall 3)					
Session/Session Chair	**Schedule**	**Code**	**Track**	**Title**	**Author(s)/Speaker(s)**
Lead Lecture and Session Chair **Dr. Anirban Chowdhury**		LL-10	**Cognitive Processing and Response**	Human Factors and Behavioural Design	Anirban Chowdhury
	15:30	P--54		Empathy, Vulnerability and learning theories in Higher Education	Vikram Mathur, Anirban Chowdhury
	15:50	P-117		Driver behaviour as an influential factor for enhanced long distance bus travel experience as applied to elders doing pilgrimages – A survey based study	Chinmaya Krishnan G, Prof. Debkumar Chakrabarti
	16:10	P-302		P302. Cognitive Status of Adult Bengalee Male Individuals Undergoing Training in Football	Satabdi Bhattacharjee, Tanaya Santra, Ayan Chatterjee, Sandipan Chatterjee, Surjani Chatterjee, Neepa Banerjee, Shankarashis Mukherjee
	16:30	P-48		Development of an Effective Scale for Measuring Empathy of Indian Nurses	Manisha Mohan, Anirban Chowdhury, Suresh Sharma
	16:50	P-157		Workload assessment methods on Train Station Control Room	Madhura Vaidya, Anupam Tiwari
	17:10	P-150		Interrelation of multiple intelligences – an approach to enhance learning	Tulika Borah, Juri Baruah, Amiya Bhowmick
December 2, 2021, Parallel Session **3D (15:30-17:30)** (Hall 4)					
Session/Session Chair	**Schedule**	**Code**	**Track**	**Title**	**Author(s)/Speaker(s)**
Session Chair **Dr. Sharmistha Banerjee**	15:30	P-264	**Design application and communication**	A Human Centred Approach to Redesign Prefab and Modular Bamboo Houses	Dipanka Boruah
	15:50	P-176		Sustainability a tool for employment opportunities	Abhishek Singh, Pratul Chandra Kalita, Raksha Singh
	16:10	P-257		Depiction of Interaction and Effective Waste Management Planning: Design for Sustainability	Lipika Basumatary, Sandipan Bhattacharjee, Bhaskar Saha
	16:30	P-53		Proposed improvisation in gun shooting skills, especially on moving targets to enhance efficacy of shooting training vis-à-vis modern day's security preparedness	Krishna Parasaram, Urmi Salve
	16:50	P-69		Gender role portrayal in Indian advertisement: A Re-view	Partha Das, Manoj Majhi
	17:10	P-74		Sustaining Heritage Culture through Visual Narrative Design	Yendrembam Suresh Singh, Bhaskar Saha
December 2, 2021, Parallel Session **3E (15:30-17:30)** (Hall 5)					
Session/Session Chair	**Schedule**	**Code**	**Track**	**Title**	**Author(s)/Speaker(s)**
Lead Lecture and Session Chair **Dr. Abhishek Singh**	15:30	E18	**Design application and ergonomics**	A study on newness in Electric Scooter through styling exercises	Abhishek Singh
	15:50	LL-17		Motorcycle Design Ergonomics	Praveen Velagapudi
	16:10	P-3		Redesigning the Basket support for the Tea Plantation workers-Occupational Safety and Health Design	Tanya Prasad
	16:30	P-245		A peer to peer teaching model for enhancing the accessibility to and quality of education in India	Ishika Goswami, Abhishek Singh, Mithravinda KG
	16:50	P-2		Designing Cannula Cover to Avoid Infections in Central Venous Catheter	Ameya Pathak, Neela Rajhans, Atul Sajgure
	17:10	E23		Application of the novel PSAV design method for user flow hypothesis validation in user experience design	Abhijeet Shukla
	17:30	P-202		Heuristics of smartphones and tablets to identify human factors for improving user experience	Vidhita Dadarkar, Anupam Tiwari
December 2, 2021, Parallel Session **3F (15:30-17:30)** (Hall 6)					
Session/Session Chair	**Schedule**	**Code**	**Track**	**Title**	**Author(s)/Speaker(s)**
Session Chair **Dr. Rauf Iqbal** **and** **Dr. Hitesh Sharma**	15:30	P-246	**Multifacet design intervention**	Gauging Global Green Governance of the Millennium: The Roadway Towards Human Progression	Partha Naskar
	15:50	P-39		An Intensive Analysis of the Problems & Strategies implemented during the COVID - 19 outbreak: Mitigate, Recover, Rehabilitation and build Resilient communities	Riya Shroff, Ganesh Jadhav, Pankaj Dhatrak
	16:10	P-282		User-centered non-suburban Indian passenger train	Archana Archana
	16:30	P-73		Quantitative and Qualitative Study on Lifestyle of Polycystic Ovarian Syndrome or disease (PCOS/PCOD) patients	Yagnesh Gohil, Puneet Tandon
	16:50	E02		Evaluation of operators' workplace layout on Indian tractors	Rahul R. Potdar, C. R. Mehta, K. N. Agrawal, L. P. Gite,
	17:10	E11		SMARTPHONES -A Major contributor to E-WASTE	Mitali Vaidya, Anupam Tiwari
	17:30	E19		Lack of Civic Sense: Swachh Baharat Mission	Anamika Yadav

Day 3, Paper presentation [Session-2] (10:00-12:00)

December 3, 2021, **Plenary Session 1A**, Hall 1

Session	Schedule		Author(s)/Speaker(s)
Session Chair **Dr. Paresh Ghosh**	09:00	**Plenary Session**	Paresh Ghosh
	09:20		Trinath Panchal
	09:40		Abid Ali Khan

December 3, 2021, **Plenary Session 1B**, Hall 2

Session	Schedule		Author(s)/Speaker(s)
Session Chair **Dr. Prakash Dhara**	09:20	**Plenary Session**	Jim Potvin
	09:40		Prakash Dhara

December 3, 2021, Parallel Session **2A (10:00-12:00)** (Hall 1)

Session/Session Chair	Schedule	Code	Track	Title	Author(s)/Speaker(s)
Lead Lecture and Session Chair **Dr. Bharati Jajoo** **and** **Dr. Ashish Kumar Singh**	10:00	P-123	**Recent trends and Research in Ergonomics**	Ergonomic evaluation of workstation components in Work from Home settings during COVID -19 and its correlation with musculoskeletal symptoms: A self- reliant approacl	Bharati jajoo, Shweta Bhatbolan, Sudhir Bhatbolan, Reshma S Bachagoudar
	10:20	P-134		Influence of age and ability sensitive ergonomics on a workplace design	Abdur Raoof Khan, Tarush Chandra
	10:40	P-128		Contributing towards Blue economy with Ergonomic assessment of Musculoskeletal Disorder (MSD) among workers involved in Harvesting living resources.	Rajat Kamble, Avinash Sahu, Sangeeta Pandit
	11:00	P-7		Innovative Ergonomic Product Development Process by incorporating TRIZ into HCD.	T Sakthi Nagaraj, H Ganesan, R Jeyapaul
	11:20	P-36		Ergonomics analysis of working posture in household cleaning using Technomatix modelling	Rajat Pratap Singh, Parveen Kalra, Suman Kant
	11:40	P-23		Science mapping to visualize the factors influencing workers' fall from height in construction projects	Vigneshkumar Chellappa, Urmi Salve

December 3, 2021, Parallel Session **2B (10:00-12:00)** (Hall 2)

Session/Session Chair	Schedule	Code	Track	Title	Author(s)/Speaker(s)
Lead Lecture and Session Chair **Prof. Ajita D. Singh**	10:00	LL-16	**Ergonomics in sports**	Female bone health- Exercise and aging	Ajita D. Singh
	10:20	P-231		Incidence of forward head and rounded shoulder posture in sports involving overhead activities among university athlete	Sarika chaudhary, Blessy philip, umesh maurya, Shweta Shenoy
	10:40	E32		Cardiovascular and autonomic nervous system alterations during simple and quick balance test in healthy young indian adults	Anilendu Pramanik, Akshita Goel, Priyadarshni Palani, Josheeta Shetty, Bhanu Bawari, Rajatmani Tripathi, Anwar Pasha
	11:00	E15		Analysis and correlation of fitness and strength parameters in volleyball, basketball and handball players of university	Sarika Chaudhary, Bhavika Advani, Shweta Shenoy
	11:20	P-213		Comparison of the hip and trunk muscles activation between cyclists with and without low back pain	Amrinder Singh, Manpreet Kaur, Abhinav Sathe, Shweta Shenoy
	11:40	E-05		Effect of Racquet Head Type over the Muscles Involved During a Badminton Forehand Smash	Dhananjay Sharma, Anilendu Pramanik
	12:00	E-14		Comparison of Selected Biomechanical and Physiological Variables among Novice and Experienced University Basketball Athletes	Ridham Thakral, Garima Joshi, Anilendu Pramanik
	12:20	E-31		Electromagnetic field based perturbations on Heart Rate Variability in University Recreational Athletes	Garima Joshi, Soubhory Ganguly, Sudeshna Das, Anilendu Pramanik

December 3, 2021, Parallel Session **2C (10:00-12:00)** (Hall 3)

Session/Session Chair	Schedule	Code	Track	Title	Author(s)/Speaker(s)
Lead Lecture and Session Chair **Dr. Indranil Manna**	10:00	P-323	**Agriculture and Ergonomics**	Influence of Yoga Practice on Body Composition and Cardio-Respiratory Functions of Adolescent Male	Indranil Manna
	10:20	P-130		Identification of ergonomic problem of paddy harvesting due to climatic change at small scale farms of Kerala, India	Vinu Vimal V J, Neha Neha, Sangeeta Pandit
	10:40	P-86		Prevalence of Musculoskeletal Disorders (MSDs) among the Agriculture Workers: A Review	Ram Charan Bairwa, M L Meena, G.S. Dangayach, Rahul Jain
	11:00	P-179		Drudgery estimation in walking behind the power tiller during field operation	Prabhanjan Pranav, B Surya Kumar Chhetry, Mrinmoy Biswas
	11:20	E12		Occupational Safety and Health in Agricultural Sector	Jyoti Nayak, Chaitrali S Mhatre, P. K. Rout

December 3, 2021, Parallel Session **2D (10:00-12:00)** (Hall 4)

Session/Session Chair	Schedule	Code	Track	Title	Author(s)/Speaker(s)
Lead Lecture and Session Chair **Dr. Subir Das**	10:00	LL-11	**Cognitive Processing and Response**	Ergonomic Design Intervention for the Indian Industries	Subir Das
	10:20	P-97		Determination of Effects of Instrumental Music on Brain Signal using Electroencephalogram	Keerthik Dhivya Rajakumar, Jagannath Mohan, Rajeswari Jayaraj, Adalarasu Kanagasabai
	10:40	P-104		A Systematic Review of the Effects of Noise Characteristics on Human Mental Performance	Dipayan Das
	11:00	P-305		Bengalee Adolescents' auditory and allied issues:A Study in southern Bengal	Sandipan Chatterjee, Surjani Chatterjee, Bijan Kumar Saha, Sweety Bardhan, Shankarashis Mukherjee
	11:20	P-77		Consciousness in yoga for the transformation of human potentiality	Malay Sinha
	11:40	E24		Combined effect of a multi-strain probiotic and prebiotic on cognitive processes, body composition and exercise performance on university athletes after 15 days intervention	Simran Obhrai, Anilendu Pramanik, Shweta Shenoy

December 3, 2021, Parallel Session **2E (10:00-12:00)** (Hall 5)					
Session/Session Chair	**Schedule**	**Code**	**Track**	**Title**	**Author(s)/Speaker(s)**
Lead Lecture and Session Chair **Dr. Subhashis Sahu**	13:00	LL-12	**Ocupational health**	Wellbeing during lockdown and new normal life style: Ergonomic perspectives	Subhashish Sahu
	13:20	P-308		Optimizing Roti making in Street Food Outlets: A Human Factors Perspective	Sayantika Saha, Enakshi Chakraborty, Sweety Bardhan, Surjani Chatterjee, Neepa Banerjee, Shankarashis Mukherjee
	13:40	P-181		Re-design and Ergonomic Assessment of a Handcrafted Kalash Polishing Equipment	Krishna Chaitanya Mallampalli, Swati Pal
	14:00	P-35		Ergonomic risk factors among eye care specialists- A study of community outreach health camps of Assam	Abhijit Kakati, Amarendra Kumar Das
	14:20	E28		Understanding visual cultural elements of the social entry gates of Assam from the perspective of native people of the state	Hitesh Sharma
	14:40	P-224		Prevalence of Musculoskeletal Discomfort among Banking Employees in Assam, India	Porineeta Phukan, Vashima Veerkumar, Neha Rathore, Neerja Jaiswal
December 3, 2021, Parallel Session **2F (10:00-12:00)** (Hall 6)					
Session/Session Chair	**Schedule**	**Code**	**Track**	**Title**	**Author(s)/Speaker(s)**
Lead Lecture and Session Chair **Dr. Manoj Majhi**	10:00	E25	**Visual communication and ergonomics**	An exploration of multimedia in communication design	Manoj Majhi
	10:20	E26		Creativity in Digital Design: Comparison with Print-Based Graphic Design	Amitabh Bordoloi
	10:40	E35		Informal Urban Spaces and Place Identity	Somya Mishra and Debkumar Chakrabarti
	11:00	E27		An exploratory study of different visual design elements representing the culture of Madhya Pradesh, state of India	Hitesh Sharma
	11:20	P-303		Cognitive Ability improves in Indian Classical Dancing :A Study in Bengalee Female	Surjani Chatterjee, Neepa Banerjee, Sandipan Chatterjee, Sweety Bardhan, Sayantika Saha, S Mukherjee
Lunch Break (12:00-13:00)					
December 3, 2021, Parallel Session **3A (13:00-15:00)** (Hall 1)					
Session/Session Chair	**Schedule**	**Code**	**Track**	**Title**	**Author(s)/Speaker(s)**
Lead Lecture and Session Chair **Supradip Das** **and** **Shareka Iqbal**	13:00	P-31	**Design application and Ergonomics**	To explore an innovative process to offer personalized learning by providing localized accessibility for both teachers and students with the help of a mobile application	Himadri Saloi, Abhijit Padun, Abhay Verma
	13:20	P-59		Status of Political Cartoons in Indian Society: A Human Commination Perspective	Prasun Chakraborty, Anirban Chowdhury
	13:40	P-322		User Survey of UPI-enabled Payment Apps	Siddhi Chavan, Praduemna Gore, Ganesh Bhutkar
	14:00	P-239		(Fatigue analysis of recreational road cyclist in terms of blood lactate concentration and nutritional intake) Assistive devices applicable for inclusive design in Higher Educational Institute in India: A systematic review	Priyanka Yadav, D. Udaya Kumar, Sougata Karmakar
	14:20	E03		Evaluating Ergonomics and Disease Correlates with Safety Shoes Usage in Bokaro Steel Plant	R.Kumar, T. Pachal
	14:40	P-44		Exploring pedagogical influence and cognitive learning on children by implementing innovative instructional design methodology for learning english alphabet writing from drawing	Abhay Verma, Abhijit Padun
December 3, 2021, Parallel Session **3B (13:00-15:00)** (Hall 2)					
Session/Session Chair	**Schedule**	**Code**	**Track**	**Title**	**Author(s)/Speaker(s)**
Session Chair **Dr. Pankaj Upadhyay**	10:00	P-138	**Recent trends and Research in Ergonomics**	Identifying ergonomic issues and re-designing of mango plucking tool	Amol Patil, Amrita Bhattacharjee
	10:20	P-112		Preliminary Survey in FMCG Shop-floors to Understand Operational for Identifying Activities Ergonomic Stressors: A Case Study from North-east India	Gurdeep Singh, Sougata Karmakar
	10:40	P-82		Design Implementation and Academic Correlation for Harmonizing Contemporary Usage and Heritage of Bodo Traditional Attire	Chaitali Brahma, Bhaskar Saha, Prof. Debkumar Chakrabarti
	11:00	P-33	**School Ergonomics**	Understanding the usability of school stationery and the scope for innovation	Jay Khopey, Tejal Kalgutkar, Ayush Srivastav, Siddhartha Mukherjee
	11:20	P-247		The ergonomics of play - Recalibrating 'playspaces' of Thiruvanathapuram government primary schools towards inclusivity	Eva Thomas, Aishwarya Padmanabhan
	11:40	E22		The Effect of School Bag Carriage on adopted Speed and Handgrip Strength in chidren: An Explorative Study	Ruchira Mukherjee

December 3, 2021, Parallel Session **3C (13:00-15:00)** (Hall 3)					
Session/Session Chair	**Schedule**	**Code**	**Track**	**Title**	**Author(s)/Speaker(s)**
Lead Lecture and Session Chair **Dr. Subrata Ghosh**	13:00	LL-14	**Occupational Health**	In search of Novel Predictors of Aggression amongst pre-pubertal Children of Bengal: An attempt of Facial Anthropometry assisted Clinical Bio-chemical assessmen	Subrata Ghosh
	13:20	P-24		Assessment of Respiratory Health of Wood and Stone Occupation Workers: A Review	Yogesh Mishra, Ashish Singh, M L Meena, G.S. Dangayach
	13:40	P-119		An Ergonomic Evaluation for Designing Workstation for Fish Vendors	Jordan P, Priyanka Sen, Purti Barve, Rhea Mirje, Debasis Haldar
	14:00	P-182		Ergonomic Risk Factors Associated with Pineapple Harvesting Task in Northeast India	Hijam Jiten Singh, Jitesh Singh Chauhan, Sougata Karmakar
	14:20	P-315		Ergonomic risk assessment of rubber tappers using Ovako Working Posture Analysing System (OWAS)	Abi Varghese, Vinay Panicker, Jeffry Abraham, Jobin Gimmi, Judson Tom, Kevin Desini
	14:40	P-235		An Ergonomic study on Prevalence of Work related Musculoskeletal Disorder among IT Professionals Working from Home in COVID-19 Pandemic	Jigisha Patel, Tirthankar Ghosh
Valediction (Starting at 15:00 hrs)					

52	Assessment of Respiratory Health of Wood and Stone Occupation Workers: A Review	Yogesh Mishra, Ashish Singh, ML Meena, GS Dangayach	53
53	Virtual Reality Reducing Cognitive Load in Travel Planning	Aanchal Krishna, Tushar Amin, Tanmayee Puntambekar	54
54	Bucky- The study of An Ergonomic Design Intervention for a Bucket Carrying Task	Sudip Ray, Tanmayee Puntambekar, Samantha Dimal, Shivangee Tilak, Swasti Gautam	55
55	Why Does an Indian Construction Worker Fail to Wear Personal Protective Equipment (PPE) at Workplace?	Vigneshkumar Chellappa, Urmi Salve	56
56	To Explore an Innovative Process to Offer Personalized Learning by Providing Localized Accessibility for Both Teachers and Students with the Help of a Mobile Application	Himadri Saloi, Abhijit Padun, Abhay Verma	57
57	Digitized Visual Fatigue Detection for Humanizing Digital Work Environments	Prerita Kalra, Vinod Karar	58
58	Understanding the Usability of School Stationery and the Scope for Innovation	Jay Khopey, Ayush Srivastav, Tejal Kalgutkar, Siddhartha Mukherjee	59
59	Oro White Toothbrush Design and Conceptualizing Dental Caries Detection Method	Bitopan Kalita, Ashish Sharma	60
60	Ergonomic Risk Factors Among Eye Care Specialists- A Study of Community Outreach Health Camps of Assam	Abhijit Kakati, Amarendra Kumar Das	61
61	Ergonomics Analysis of Working Posture in Household Cleaning using Technomatix Modeling	Rajat Pratap Singh, Parveen Kalra, Suman Kant	62
62	An Intensive Analysis of the Problems & Strategies Implemented during the COVID - 19 Outbreak: Mitigate, Recover, Rehabilitation and Build Resilient Communities	Riya Shroff, Ganesh Jadhav, Pankaj Dhatrak	63
63	Rotating Cylindrical PIN VR Display - An Ergonomic Approach for VR Scripts	Delwyn Remedios, Deepak Mathew, Max Schleser	64
64	Braking: The Most Strenuous Task of Locomotive Driving	Subir Danda, Soumya Sarkar, Bikash Bepari,	65

79	Quantitative and Qualitative Study on Lifestyle of Polycystic Ovarian Syndrome or Disease (PCOS/PCOD) Patients	Yagnesh Gohil, Puneet Tandon	80
80	Sustaining Heritage Culture through Visual Narrative Design	Yendrembam Suresh Singh, Bhaskar Saha	81
81	A Sustainable Approach for the Urban Sprawl of Kolkata (Circa 1690-2020)	Shilpi Chakraborty, Shiva Ji	82
82	Working Posture Evaluation of Bus Drivers - using CMDQ and RULA Technique	Soumyajit Das, Sujit Patra, Subir Danda, Bivash Mallick, Avishek Pandey	83
83	Consciousness in Yoga for the Transformation of Human Potentiality	Malay Sinha	84
84	Sustainability: Indian Cultural Heritage through Game Design Concept	Swarnadeep Nath, Subash Rai, Bhaskar Saha, Debkumar Chakrabarti	85
85	Design Implementation and Academic Correlation for Harmonizing Contemporary Usage and Heritage of Bodo Traditional Attire	Chaitali Brahma, Bhaskar Saha, Debkumar Chakrabarti	86
86	Design of Safety Helmet for Construction Workers and Evaluation Using Digital Human Model	Ashish Thulkar, Anirban Chowdhury	87
87	Prevalence of Musculoskeletal Disorders among the Agricultural Workers: A Review	Ram Charan Bairwa, M L Meena, GS Dangayach, Rahul Jain	88
88	Thermal Performance of Green Roof and Conventional Roof in the Warm Humid Climate of India	Rebecca Varghese, Amalan Kaushik	89
89	Postural Assessment of Indian Floor Tilers' using OWAS, REBA, ERIN and WERA Methods	Manoj Gajbhiye, Debamalya Banerjee, Saurav Nandi	90
90	An Exploration of Animation Support to Documentary Film for Better Communication	Subash Rai, Swarnadeep Nath, Prof. Debkumar Chakrabarti	91
91	Analysis of Risk Factors (Psychological and Musculoskeletal Disorders) Associated with Smart Phone Usage among Indian Users	P Shrisowmya, Kanagasabai Adalarasu, S Monisha Gowri, T Aravind Krishna	92
92	Determination of Effects of Instrumental Music on Brain Signal using Electroencephalogram	Keerthik Dhivya Rajakumar, Rajeswari Jayaraj, Jagannath Mohan, K Adalarasu	93

93	Development of Risk Assessment System for Sewing Machine Operators	Aastha Arora, Manoj Tiwari	94
94	Re-learning Puberty: Minimising Period Shaming in Urban Schools	Kavya Kulshreshtha, Saurabh Tewari	95
95	Development of Mastectomy Bra for Breast Cancer Survivors	Kritika Dhawan, Shivangi Sahni, Manoj Tiwari	96
96	A Systematic Review of the Effects of Noise Characteristics on Human Mental Performance	Dipayan Das	97
97	Potential Benefits of Corporate Social Responsibility (CSR) in the Construction Industry	Vigneshkumar Chellappa, Grzegorz Ginda, Urmi Salve	98
98	Preliminary Survey in FMCG Shop-floors to Understand Operational Activities for Identifying Ergonomic Stressors: A Case Study from North-east India	Gurdeep Singh, Sougata Karmakar	99
99	Analysis of Body-Gestures Elucidated Through Elicitation Study for Natural Locomotion in Virtual Reality	Priya Ganapathi, Keyur Sorathia	100
100	Driver Behaviour as an Influential Factor for Enhanced Long Distance Bus Travel Experience as Applied to Elders Doing Pilgrimages – A Survey Based Study	Chinmaya Krishnan G, Prof. Debkumar Chakrabarti	101
101	Comparative Visual Analysis of Brick Architecture Ornamentations of the Ahom Monuments in Sivasagar, Assam, India	Saurav Deori, Utpal Barua	102
102	An Ergonomic Evaluation for Designing Workstation for Fish Vendors	Jordan P, Priyanka Sen, Purti Barve, Rhea Mirje, Debasis Haldar	103
103	Ergonomic Evaluation of Workstation Components in Work from Home Settings during COVID -19 and its Correlation with Musculoskeletal Symptoms: A Self-reliant Approach	Bharati Jajoo, Shweta Bhatbolan, Sudhir Bhatbolan, Reshma S Bachagoudar	104
104	Participatory Design of a Computer Mouse	Pranjal Protim Borah, Swati Pal, Shimmila Bhowmick, Keyur Sorathia	105
105	Contributing Towards Blue Economy with Ergonomic Assessment of Musculoskeletal Disorder (MSD) among Workers Involved in Harvesting Living Resources	Rajat Kamble, Sangeeta Pandit, Avinash Sahu	106
106	Identification of Ergonomic Problem of Paddy Harvesting due to Climatic Change at Small Scale Farms of Kerala, India	Vinu Vimal V J, Sangeeta Pandit, Neha	107

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107	Perception and Continuous Intention of Wearable Fitness Trackers among Different Age Groups: En-Route Towards Health and Fitness	Swati Sarkar, Prof. Debkumar Chakrabarti	108
108	Influence of Age and Ability Sensitive Ergonomics on a Workplace Design	Abdur Raoof Khan, Tarush Chandra	109
109	Impact of Acoustic Distraction and Overcrowding on Cognitive Performance of Healthcare Professionals	Abhijit Kakati, Amarendra Kumar Das	110
110	Identifying Ergonomic Issues and Re-designing of Mango Plucking Tool	Amol Patil, Amrita Bhattacharjee	111
111	Identification of Ergonomic Risk factors in Dhokra Bell Metal Handicraft Industry of Chhattisgarh, India	Avinash Sahu, Rajat Kamble, Sangeeta Pandit	112
112	Ergonomic Study in Information System Design of Two Major Railway Platforms of India	Jigyasa Patankar, Rajat Kamble, Suyash Krishna, Sangeeta Pandit	113
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Section-A
Keynote lecture, Plenary lecture & Lead lecture

Human Factors and Ergonomics in Developing Countries: Perspectives and Challenges

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Abstract: Developing countries face a double challenge on the way to their long-awaited industrial development, and now more than ever having to take into account sustainable development in all senses and seek to develop a constant improvement in the design of jobs, as well as developing technology to manufacture increasingly more adequate and ergonomic products.

In this sense, FHE domain is a very important ally for this much-desired development, certainly cooperating with other areas of knowledge, not only in the training of technicians and professionals who will implement this complex process of development, but mainly in the sense of contributing to the strengthening of the research and development sector of all public and private organizations in these countries.

Thinking strongly about these problems, the IEA has been developing and implementing the 7 strategic policies in order to support the development of member societies in their growth and recognition in national and regional spaces, in order to build articulation with influential and vital stakeholders for this process, both in the academic sphere, as well as in the public and private sectors of the societies of these countries.

Last but not least, the focus on the future of work and sustainability become pillars of all ergonomic action in the 21st century and therefore a systematic approach and analysis of the activity are more than desired, they are mandatory requirements for development and design of solutions for a society with better living and working conditions.

Think About Our Professional Profile as HFE Specialist

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Abstract: IEA recognizes that (1) HFE is design-driven, (2) HFE needs to be systemic (holistic) and take systems approach, and (3) HFE needs to engage various stakeholders. After a brief introduction of the notion of "resilience," the presentation discusses how people can be resilient in uncertainties taking into various human characteristics that shape cognitive processes, and the need for the stakeholder engage-ment. The presentation concludes that the discussion clearly supports the three recognitions mentioned above, and that people will reach the same conclusion regardless of their expertises. The presentation ends with a comment that we need to think about the difference between professional recognition and professional ability/competency.

A Road Map for Indian Ergonomics

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Abstract: The future of ergonomics and the future of work are interdependent. Much of the changes that became necessary due to the infection control requirements of the pandemic, such as Work From Home, have or are becoming permanent features of our lives in various degrees. The future of work in the form of remote work or virtual work has also ushered in changes in the workplace itself. Activity Based Work and Activity Based Work-places are the shape of things to come, and are going to both shrink and transform offices and work-places. Ensuring good posture, preventing musculo-skeletal disorders, preventing computer vision syndrome, and promoting psycho-social well-being are the new frontiers of Human Factors and Ergonomics.

The proposed road map for Indian ergonomics pertains to three different future focus points – extension and outreach, academics including research, and practice.

First, we primarily need to identify the various stake-holders and members of related disciplines and collaborate with them extensively for increased synergy. The Indian Society of Ergonomics has initiated collaborative activities with the CII, IAOH, and the BIS, among others, and this effort to identify and collaborate at all levels must be intensified and broadened.

Teaching in ergonomics needs to encompass all the domains of the discipline – physical, cognitive, and organizational. Syllabi must be structured to contain all the Human Factors / Ergonomics (HFE) core competencies so as to standardize the course content and align them to the requirements of professional certification. Also, we must develop a network of universities and academic institutions for collaborative research, and connect to the BRICS and ACED networks for maximum mutual benefit. The existing and rising need for ergonomics evaluations and interventions, needs to be translated into actual demand for our services by stake-holders and interested parties by a system of professional certification of ergonomics practitioners, and by training and development of skills in organizational ergonomics.

Last, but not the least is the need for ergonomics to be participative at all levels. The Participatory Project Development Tool – P2DT in short – developed by the International Ergonomics Association must be made an important part of any ergonomics project and implemented comprehensively.

Sustainable Built Environment: Ergonomics Concern

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Abstract: The built environment denotes the physical, spatial and behavioural environment. The federative science and technology of Ergonomics (the Greek word, ergon, epyov - work, and nomos, νομο□¬ - principles or laws) embedded with requirements for sustainability of the built environment for human use, comfort and safety. This contribution elucidates plausible links of building characteristics, indoor physical layout, and environmental quality to occupants' health, comfort, satisfaction, and productivity. Globally, the buildings stock consumes nearly 40, 25, and 40% of the energy, water, and resources, respectively, and is responsible for 1/3rd of the total greenhouse gas emissions. The criticality of green building practices recognize measures and approaches for (a) site and structure design efficiency, (b) efficient use of energy, water, and other material resources, (c) reduction of waste, pollution and environmental degradation, (d) enhanced IAQ, ventilation, thermal comfort, daylighting, and acoustical environment, and (e) optimization of operation and maintenance. Various building assessment tools (e.g., BREEAM, LEED, HQE, DGNB, CASBEE, Green Globes, SBTool, and other national schemes) are discussed. These tools have a relatively greater presence in building accreditation in urban locales and commercial enterprises. The presentation covers the scope of application of the concept in rural and low-cost environments to create a standard as-

Humanizing Work, Work Environment and Ergonomics of Organisational Systems

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Abstract: Work involves the application of physical or mental efforts, skills, knowledge, or other personal resources, usually includes a commitment over time, and is carried out through the application of effort/s and a need to exert oneself. (https://www.dictionary.com; Warr 1987; OECD 2003). Work is not only 'a job' or paid employment, but comprises unpaid or voluntary activity, education and training, family responsibilities and caring. Work is central to individual identity, social roles, and social status of a human being. (Waddell and Burton, 2006).

A work environment is the setting, social features, and physical conditions in which one carries out one's work. A specific setting of a work environment can have an impact on the feelings of well-being, relationships, collaborations, efficiency, effectiveness, and health. (https://www.indeed.com/career-advice/finding-a-job/types-of-work-environments: accessed on 28.11.2021). Work environment consists primarily of (a) physical work environment and (b) psychosocial work environment.

"Physical work environment is the part of the workplace facility that can be detected by human or electronic senses, including the structure, air, machines, furniture, products, chemicals, materials, and processes that are present or that occur in the workplace, and which can affect the physical or mental safety, health, and well-being of workers.

Psychosocial work environment is the organisation of work and the organisational culture; the attitudes, values, beliefs, and practices that are demonstrated on a daily basis in the enterprise/organisation, and which affect the mental and physical well-being of employees. These are sometimes generally referred to as workplace stressors, which may cause emotional or mental stress to workers". (WHO, 2010).

"Well-being is the subjective state of being healthy, happy, contented, comfortable and satisfied with one's quality of life. It includes physical, material, social, emotional ('happiness'), and development & activity dimensions." (Felce & Perry 1995; Danna & Griffin 1999; Diener 2000).

Hazards and risks in the workplace have been observed to have possible harmful impacts on workers' physical, mental, social health and well-being. (Bosma et al., 1998; Tennant, 2001; NIOSH, 2002; Chen, Yu & Wong, 2005; Fischer et al., 2005; EU-OSHA 2007; Bonde, 2008; Wieclaw et al., 2008; WHO, 2010).

Ergonomics plays a significant role in alleviating some of these possible harmful effects. Ergonomics practitioners employ various methods and tools of Ergonomics for arriving at such solutions. They usually work to find out solutions for unitary problems, i.e., one person working with one machine or carrying out a job and often in a specific work environment. Such solutions are usually arrived at within the domain specialisations, viz, physical ergonomics, cognitive ergonomics, and organisational ergonomics, of ergonomics specialists. Due to the changing technology, social systems and nature of business, organisations become complex, flexible, large, multilocational and often are separated with different time zones, and in many cases they are virtual. Therefore, applications of ergonomics to address to the unitary problems for arriving at one-to-one solutions and applications of domain specific specialisations by an Ergonomics specialist in these new organisational systems and new work environment may not be contextual. Innovative approaches with newer methods and newer tools for providing appropriate Ergonomic solutions to address the human factor and organisational problems of these new, complex, flexible, and virtual work systems and for different persons with dissimilar needs and working in different and diverse work environmental settings probably be necessitated. (Chapanis,1979; Hendrick,1997; Carayon and Smith, 2000; Wilson, 2000).

Keeping the above in mind, 'Humanizing Work and Work Environment (HWWE)' conference series for providing a platform to the Ergonomists to discuss the impact of Ergonomics applications on Work and Work Environment with view to make them 'contextual and humane' was started in 2001 in IIT Bombay. This year, i.e., 2021 is the 20th year of this conference series.
Two thousand twenty one is also important for Ergonomics in India. It is the (a) 50th year of the introduction of Ergonomics as a special subject in any academic programme in India. In 1971, Work Physiology and Ergonomics was introduced as a special paper in M.Sc. Physiology programme of the University of Calcutta for the First time in India. (b) 20th year of the establishment (release of funds) of a 'Centre of Excellence in Ergonomics and Human Factors Engineering (CEEHFE)' by the Department of Science and Technology (DST), Government of India and (c) 15th year of the introduction of 'Diploma Ergonomics (DErg) Programme', first of its kind in India.

In this paper, an attempt has been made to look back, introspect and to understand some of the concepts of work, work environment and ergonomics of organisational systems; their impacts on people, organisation and society and put forward some thoughts.

In Pursuit of Innovation
'Practice-based Learning & Processed-based Learning'

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Abstract: 1760-1840 the transition of Handmade Design 'practice' to Mechanical Production took place in Britain, Europe and the US. Steam Engine powered machine tools and mechanized production system introduced a new era of design process. The process geared up to revolutionize a new concept of mass-production, design productions that had tremendous impact on GDP growth which eventually led to the Industrial Revolution.

During the last decade Design Innovation has become one of the most sought-after areas. A number of heads of nations have announced that Innovation would be the 'future currency' of a nation. Today every country is announcing various strategic policy to enhance innovation-oriented policy. Naturally Government of India is also floating various schemes (educational, entrepreneurship, national policy of design, etc.) to encourage innovation-oriented design programs.

The Modern Design concept since Industrial Revolution, started shaping the future course of innovation based on 'Processed-based Design'. Present day (mass production) technology-based process does not count on 'intuitive-knowledge' because it may have errors. In order to minimize the infallibility and produce quality-controlled products, we have been solely dependent on technology-based tools and hence sacrificed the intuitive creative practices. We have started believing in the notion that technology would generate innovation. We have forgotten, technology produces tools not innovation.

In order to understand the genesis of creativity in design and innovation, one cannot escape from the knowledge of 'Practice-based Design' (Handicraft) approach. Around the world the Handicraft Culture has developed knowledge-based practice through continuous process of learning. Learning by hands-on experience builds vast 'intuitive-knowledge'. The technology-based knowledge, does not count intuitive knowledge-based design practice is very reliable. In result, we have sacrificed 'human emotion' that is integral to handmade products.

If Innovation is the key to Design Profession, 'practice' would be the first step followed by processes. In traditional art form, the expression of the form is based on the 'experience of perception'. The practice emphasizes aesthetics by developing a serious understanding of form, materials and sue of experimentations and manipulation. It generates 'accidental learning' to help developing tacit knowledge associated with intuition. A craft or artisan's design approach requires a substantial understanding of designer's 'intuition' to realize functionally and aesthetically meaningful outcomes. Naturally, the quantitative approach (Design Process) would be wary of the intuitive practice because of an element of uncertainty.
Therefore, if we accept Handicraft has relevance in today's society, we need to respect and understand the potential of Intuitive Design', which craft has the legacy of thousands of years. Craft has its intrinsic value. Therefore, instead of weighing the merits of Practice-based Design and Process-based Design, we need to take a holistic approach to integrate them into a seamless process. In author's view, it would naturally through up a challenge and if done correctly the outcome would be a rewarding innovative solution for the society. The author accepts that each has its merits and demerits. Hence, a selective way to integration would generate higher dividend than showcasing crafts-based designs curio for decoration.

HFE and Industry 5.0 – The Future of Work

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The world of work depends heavily on effective HFE to ensure health, safety, and sustainability of workers and organizations. Work today comprises a wider disparity in work situations than ever before, and HFE professionals must address issues that range from physiological threats such as musculoskeletal disorders or injuries from physical work, especially in IDCs, to cognitive and psychological threats stemming from new information technology, robotics, artificial intelligence, and digitalization. Multiple types of work arrangements including the informal and 'gig' economy may interfere with the management and regulation of HFE issues at the organizational level and leave workers with no protections or HFE provisions for safety and well-being. Technological advances such as new information and communication technology, robotics, artificial intelligence, and digitalization have resulted in tasks being increasingly automated or robotized, often with little attention to the impact of changed job requirements on stress, workload, and worker sustainability – all of which are HFE concerns. These HFE challenges must be met in order to ensure sustainable workers and work systems.

Industry 5.0 is a new paradigm for work that reflects the principles of HFE design. Industry 5.0 has a triple mandate for work – to be human-centric, to be resilient, and to be sustainable. According to the European Commission* a human-centric approach in industry promotes human talents, diversity, and empowerment and puts core human needs and interests at the heart of the production process. We focus on what technology can do for us. We use technology to adapt the production process to the needs of workers. We make sure that the use of new technologies does not impinge on workers' fundamental rights, such as the right to privacy, autonomy, and human dignity. The well-being of the human is a top priority of the process.

Industry 5.0 focuses on agility and resilience with flexible and adaptable technologies, respects planetary boundaries, and focuses on sustainability. It calls for the development of circular processes that re-use, repurpose and recycle natural resources, and reduce waste and environmental impact. Sustainability means reducing energy consumption and greenhouse emissions, to avoid depletion and degradation of natural resources, to ensure the needs of today's generations without jeopardising the needs of future generations. We can use technologies such as AI and additive manufacturing to optimize resource-efficiency and minimize waste.

Basically, this paradigm calls for a partnership between intelligent humans and smart machines – a convergence of human cognition and artificial intelligence so that technology serves humans rather than technology being the driver of human activity. It offers a strategy and rationale for HFE in the design of work and work systems that can be applied by HFE researchers and practitioners to create a future of work that embodies HFE principles.

*Note – these sections taken from
Directorate-General for Research and Innovation, European Commission (2021). *Industry 5.0: Human-centric, sustainable and resilient.*

DeNul, L., Breque, M., & Petridis, Athanasios, Directorate-General for Research and Innovation, European Commission (2021). *Industry 5.0: Towards a sustainable, human-centric and resilient European industry*

Need of Ergonomics in Designing Machine Seat and Cabin to Control MSDs for Indian Mine Operators

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Abstract: At present India ranks second in world coal production while stands fifth in coal reserves globally. The outcrop coal (deposit closer to the surface) is getting exhausted quickly as the demand of coal is increasing within the country. Consequently, there is a possibility of future coal mining to get shifted towards deeper mines. Having followed the need, mechanization has already been roped in almost every coal subsidiary having underground coal mines. Different mechanized mining, like Continuous mining, Long-wall, Bolter miner and Road header, are associated with different machine based sub-systems like Shuttle car, Load haul dumper etc.. Therefore, 8 hours continuous stretch of operation sitting on such machine has now become the need of the business. So, the scope of appropriate designing of seat and cabin of that machinery is substantially high in Indian Mining sectors. Moreover, human stress growth behavioral pattern, fixation of suitable workload and muscle force (MF) as a response to varied stress factors in deeper mines, is nearly unknown in Indian mines. Consequently, monitoring and controlling of fatigue sustainability and postural stress for a continuous mine unit operation under a hectic working environment need a proper insight in Indian mining industries. The topical mining domain involving HEMMs, coal face loading machines are yet to get proper attention from the stake holders. It is well known that work stress related physiological problems especially, postural stress and low fatigue sustainability (FS) poses a significant challenge in day to day mining operation. Mostly in Indian mines work pattern of machinery operation adopted is not suitable for continuous job and thereby contribute to some potential future risks of musculoskeletal disorders in the form of low back pain. Moreover, modern occupational health and safety (OHS) legislation states the requirement of detailed risk assessment of work procedures to ensure safety. It is also prescribed that machineries should be aptly and ergonomically designed, manufactured, supplied, installed and used having negligible possibility of risks to the health, safety, and comfort of operators. Significant emphasis has also been given in different provisions (126 and 215) as stipulated in current Indian coal mine regulation (CMR 2017). Therefore, postural stress related research theme should be given utmost emphasis primarily to manage musculoskeletal disorder at mines and specifically to increase muscle fatigue sustainability of miners.

Keywords: continuous mining, health and safety, machinery, postural stress, muscle fatigue

Humanizing Construction Workplace - Problems and Possibilities

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Due to rapid economic growth and urbanization construction industry has become one of the leading job creators in the past few decades. In India, construction sector provide employment to over 55 million workers, which is considered the largest sector after agriculture in terms of employment. In addition to engagement of large workforce, construction sector is also one of the biggest contributors to national GDP amounting to 9 to 11% approximately.

However, construction industry's rate of occupational accidents, injuries and ill health is high due to several reasons. As per ILO estimate nearly 2.78 million people around the world succumb to work-related accidents or diseases every year while nearly 374 million occupational accidents annually. With limited data from Indian construction industry, it is estimated that 11614 workers die due to occupational accidents annually. Typical constituents of construction involve high risk, such as working at height, work with heavy machinery, deployment of unskilled workmen, presence of subcontractors, high rate of workmen turnover etc.

In addition to these intrinsic characteristics, transient nature of the job, poor working conditions, extended working hours, lack of welfare facilities etc. make construction workers highly susceptible to physical and mental fatigue. Construction works still being labour intensive and demanding, presence of physically fit and healthy workforce at the workplace is necessary to achieve the intended operational outcomes.

Preventing fatality and ensuring safety and wellbeing of the workmen is the duty and a major responsibility of the employer. However, many a times, working conditions and the facilities provided to the construction workmen are below par with reference global standards or even domestic statutory requirements. Organizations need to adopt multi-pronged approach to address all the underlying factors to ensure long lasting effect in facilitating safer and healthier. In the recent past keeping pace with global initiatives, India has started embracing the strategy of "Vision Zero". Its concept and fundamental principles in fact present enormous opportunities in shaping the organisation's workplace cultural transformation. Involvement of leadership and their commitment to betterment of workplace culture, timely risk mitigations, improvement of workplace conditions such as ergonomic interventions to reduce the physical impact on human body, optimising work hours and enhancing the adequacy and quality of welfare facilities at the workplaces and workmen habitat can significantly influence the health and wellbeing of workmen associated with construction works.

Decent working environment makes employees safe, healthy, happy and more committed at work. This also leads to reduction in number of complaints and absenteeism and an increase in productivity and quality of product with high morale among the workforces. Hence, it is necessary for all stakeholders, including government, employers, employees and their representatives should come forward to drive the change and make workplaces safer, healthier and more humane.

Ergonomics in Industry 4.0 Era

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Abstract: Presently we are living in a digital world and digitization is ongoing throughout Bangladesh. We can say that the world is becoming smaller day by day but it does not mean that the word "smaller" concept is related to the size of this earth planet but with Information Communication Technology (ICT), Operational Technology (OT), and worldwide networking. Industry 4.0 makes the manufactur-ing/production/operation a value-added creation process through digital transformation. The term Indus-try 4.0, shorten to 4.0 or simply 4, originated in 2011 from a project in the high-tech strategy of the Ger-man government, which promotes the computerization of manufacturing. The term industry 4.0 was publicly introduced in the same year at the Hannover Fair, Germany.

Although in its conceptual state, Industry 4.0 promises a revolutionary leap in manufacturing industries for the next 10-20 years. Industry 4.0 is defined as a computerized manufacturing industry with connect-ed intelligent devices, machines and physical objects; the goal is to construct an intelligent factory which is characterized by adaptability, resource efficiency and ergonomics. It integrates customers and business.

Under the environment of industry 4.0, smart factory aims to produce precise, 4 high-quality and per-sonalized intelligent products, so as to achieve the efficiency and cost of mass production in small batch production of single parts. Intelligent production can carry out large-scale small batch customization for enterprise customers, or small batch single product customization for individual users. Factory produc-tion in industry 4.0 environment has the following characteristics:

The paper gives a brief history and connotation of the development of industry 4.0, as well as the devel-opment requirements of ergonomics in the new era and the common features of the emerging technolo-gies of man-machine engineering in industry 4.0.

Keyword : Industry 4.0, ergonomics, human interaction, application of modern technologies.

Ergonomics Interventions in Sports for the Persons with Disability

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Abstract: Inclusion of the visually impaired persons in the mainstream activities is a part of the Sustainable Development Goals of United Nation. A number of UNESCO Chairs are working to formulate, exe-cute and rethink on the methods for creating inclusive environment. We all are aware that regular physical activity can help in preventing several adverse health conditions. However, participation of disabled per-sons in physical activity remained rather neglected until the beginning of Paralympics and Special Olym-pics. Medal tally contributed in sports by the 'Persons with Disability (PwD)' is quite impressive compared to the non-disabled group. The present brief lecture would aim to highlight some of the developments in India in respect to the sports for the PwD.

Impact of COVID-19 on Indian Informal Sectors and Informal Economies

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Abstract: The novel corona virus which causes COVID 19 had given a massive impact on economy mainly due to sudden lockdown which stops all kinds of global supply chains. These impacts are more prominent and severe in informal economy. Diversification of business has been one of the noticeable trends during the COVID period. This trend is most observable in the informal economy. Due to government-imposed regulations during COVID-19 pandemic, the production units (small and medium enterprises) had to shut down. As a result, the workers who were involved in such work were temporarily laid off. It has been observed a big surge of migrant laborers returning to their hometowns. The lack of proper raw material supply and the disruption in supply-demand balance were major causes of the ill health of the informal economy during the lockdown. Over 700 million informal workers live in extreme poverty, and often cannot bear the financial and/or opportunity costs of receiving health services and losing a day's work.

Women make up the largest proportion of the most vulnerable informal workers due to a combination of factors: they occupy the lowest paying informal jobs, maternal health needs are not met by employment conditions, and working conditions often subject them not only to bodily harm but also psychological and sexual abuse. Government of India rolled out a relief package of ₹1.7 lakh crore targeted at the most vulnerable sections–including construction workers, farmers, poor women, and the urban poor. This included additional rice, wheat, and pulses for the poor, a hike in Mahatma Gandhi National Rural Employment Guarantee Act (MNREGA) wages, and an ex-gratia amount of ₹500 per month for the next three months for women account holders under the Jan Dhan Yojana.

Recently, we have conducted a study find out the effect of lockdown on the businesses of informal sectors and informal economies during COVID 19 in 2020. The randomly selected informal sectors are agriculture, tobacco, printing and binding, food and beverages. The informal economies workers are from the occupations of barber, tailor, sellers of vegetables, fruits, fishes and meats and car mechanics. A questionnaire containing 30 questions on business trends is distributed to each of 40 participants for responses. The findings reveal the significant differences in responses on business strategies among workers in the informal sectors and informal economies. Workers in the informal economies during lock down quickly change their businesses for survival, whereas, in case of informal sectors, it is difficult for them to change existing businesses.

Keywords: Corona Virus, Unorganized Sectors, Questionnaire, Occupations, Businesses

Autonomous Behaviour of Digital Human Models for Ergonomics

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Abstract: Ergonomics is predominantly an experimental science which develops knowledge about human capabilities, limitations, and their implications in task-performances. Ergonomic work and work-environment ensure safety, comfort, and efficiency. The diversity of practical tasks and attributes of human subjects poses challenge in characterizing arbitrary man-machine interactions based on the understanding of specific or standard experimentations. Thus, mock-ups and simulations for ergonomics remain important in various stages of design, manufacturing, and usage of products.

Simulations in a representative work scenario involve enactment of representative tasks by representative users. Validity of the observations and inferences from a simulation not only depend upon the expertise of the researcher but also on its fidelity with respect to the real-world scenario. Flexibility and versatility offered by the digital environment makes Digital Human Modelling (DHM) a highly promising environment for ergonomics simulations.

In DHM systems articulated, anthropomorphic, digital agents are programmed to perform the given tasks in a digital work-environment and different performance parameters are noted to assess the task and safety. In a design scenario, the parameters that define the DHM, task and work-environment are then systematically varied to arrive at the optimal condition. This is akin to empirical experimentations in a digital environment.

Traditionally, DHM based simulations has been used extensively in automotive industry for physical ergonomics namely, reach, access, visibility and postural safety. These simulations are typical performed separately as discrete actions. In real human performance there is inter-dependency of multiple human factor issues and activities involve a causal sequence of tasks/actions. Thus, scope of simulations of discrete actions his highly limited vis a vis actual experiments with human subjects performing activities.

We believe that realistic performance and assessment needs autonomy in both modality and extent of performance of a task and responsiveness to the outcomes of tasks already completed. In this paper we present DHM based simulations supporting autonomous behaviour in reach, locomotion, support seeking and output sensitive task executions; we also present a framework for simulation of unexpected outcomes that has potential of accidents.

Central to this autonomous DHM environment is a novel kinematic model that does not use DH parameters and allows mutable support, an optimization based posturing scheme, an output sensitive behaviour model and a responsive environment model. Distinctive features of each of the modules are presented with illustrative examples.

The Revised Guidelines on Ergonomics Risk Assessment for Display Screen Equipment at the Workplace: Application in Work from Office and at Home

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Abstract: One of the important activities during working regardless of different sectors of industries is the using of display screen equipment (DSE). As time evolved, the definition of user of DSE had expanded form a fix DSE to portable, and smaller in size. Previous Guidelines on Occupational Use of And Health for Working with Video Display Units (VDU's) 2003 is outdated and did not include various type of equipment related to DSE and different activities.

To revise and develop a new Guidelines on ergonomics for display screen equipment at the workplace 202X that suit with the current trend. A combination of experts from academia, industries and the government involved in the revision of the Guidelines (GL).

The new GL consist of 11 chapters including (1) Introduction (which covers the background, purpose, scope and application, benefits and normative references for the GL), (2) terms and definitions used in the GL, (3) legal requirements and international standards which are related to the GL, (4) risk factors of display screen equipment towards the users, (5) health effects of usage of DSE, (6) the framework for DSE assessment which incorporate and improves upon the framework use of the Guidelines on Ergonomics Risk Assessment at Workplace 2017 by establishing additional information and assessment specifically for the use of DSE at the workplace. In chapter 7, 8, 9 and 10, the revised GL includes contents which are required for the initial and advanced ergonomics risk assessment such as the (7) review of assessment, (8) responsibility and accountability of employees, employers and person performing the assessment, (9) instruction, training and consultation and (10) record keeping. The final chapter describes suggested improvements and best practices which include the principle of hierarchy of control, engineering in design and administrative control. Several appendices in assessing at several level of assessment was included. In addition, steps in visual exercise and entire body exercise were described in giving idea for improvement for those using prolong hours with DSE.

With the use of the revise GL, there is possibility enhancing the reduction of the prevalence of ergonomics related problem in the near future regardless working in the office environment or working continuously at home.

Keywords: Display Screen Equipment, Guidelines, Ergonomics, Computer Visual Syndrome

Design of a Dry Land Rowing Simulator Model

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Abstract: Rowing is a sport in which one or more rowers use their muscular strength to propel the boat towards finish point. Competitive rowing is a challenging sport in which a rower must have a suitable anthropometric profile along with highly evolved aerobic and anaerobic capacity. Additionally, the rower needs intensive training to get aligned to the requirements of the sport. The most popular training aid is ergometer which enhances performance but makes them prone to discomforts. Although ergometers are extensively used for physiological testing of rowers yet little evidence is there to support that ergometer rowing replicates experience similar to on-water rowing. Studies have indicated that a potentially valuable training tool is the one which has feedback mechanism for both novice and elite rowers with quantitative information about rowing biomechanics. Although there are few types of simulators which use virtual environment to give experience similar to on-water rowing, they are very expensive and complicated systems. In view of the above, the present study was conducted to design dry land rowing simulator which gives an experience similar to on-water rowing. An attempt was made to develop a dry land rowing simulator model similar to on-water single scull rowing using human centered design approach is covered. After conducting user study and identifying user requirements, five concepts were proposed. Subsequently, several design iterations were tested and based on the feedback from the users, final model was developed. It was found that different performance parameters such as Handle Force, Seat Force, Foot-Stretcher Force, Seat Displacement along with the other parameters like Stroke Rate, Speed, Power and Time to cover specific distance could be analysed. This will help in mapping and predicting the performance of rower. However, longitudinal studies on larger sample size will help in achieving better predictive performances results.

Keywords : Performance, Rowers, competitive rowing, training

Ergonomics and Design for Reducing Discomfort

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Abstract: Discomfort is experienced by professionals and workers at all levels. The principles of ergonomics are applied to eliminate or alleviate the discomfort in products as small as a wristwatch to products as big as an aircraft. A few case studies are reported in this paper in which the methods based on ergonomics are applied for providing comfort to the users. The case studies are as follows: Reduction of discomfort experienced by (i) foundry workers, (ii) IT professionals, (iii) workers during material handling, (iv) Two-wheeler mechanics, (v) Laptop users, (vi) workers using hand tools, (vii) construction workers using troweling tools and (viii) workers collecting scrap materials in industries. Rapid Entire Body Assessment (REBA) and Rapid Upper Limb Assessment (RULA) are used to analyze the posture and to measure the discomfort. The resulting scores are used to bring awareness to the users on the necessity for making the changes in the workplace to reduce the discomfort. It is suggested that awareness programs are to be conducted to industry workers as well as professionals so that everyone is aware of the principles of ergonomics and apply them in their daily life to be more productive and comfortable with their work.

Manual Material Handling in Rice Mills

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Abstract: Manual material handling (MMH) in rice mills is labour intensive operation and is usually carried by the male workers. The tasks performed in MMH are handling of: unloading of paddy bags from vehicle to the rice mill godown; paddy bags from godown to rice mill and loading of milled rice bags in vehicle. The weight of a paddy bag ranges from 35-45 kg. The milled rice is packaged in 50, 25, 10 and 5 kg. During unloading of paddy or loading of rice mills, the workers usually carry load in two modes namely in head or back. Heart rate of the workers was measured during load carrying among 12 workers in four rice mills. Time motion study was also performed for different task of MMH in the rice mills.

It was observed that the workers carry the bags on the head for placing it in higher elevation while bags are carried on back for placing it below the level of waist. The average horizontal distance, vertical distance, load carrying time and return time during unloading of paddy from the vehicle were found to be 9.62 m, 1.47 m, 13.07 s and 12.19 s, respectively. The frequency of lift per minutes was found to be 2.52. The average resting and working heart rate during unloading of paddy was found to be 73 and 126 bpm, respectively. The average horizontal distance, vertical distance, load carrying time and return time during unloading of paddy from the vehicle were found to be 16.10 m, 2.20 m, 25.31 s and 28.89 s, respectively. The walking speed with load and without load were 0.58 m/s and 0.64 m/s. The walking speed during loading of rice bags was less compared to walking speed during the unloading of paddy bags. The mean resting and working heart rate during loading of rice were found to be 76 and 146 bpm. Unloading of paddy and loading of rice bags falls under heavy work category.

Keywords: Rice mills; heart rate, time motion study, load carrying

Women and Work Environment - An Ergonomic Perspective

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Abstract: Labour in the fishing industry tends to be divided along gender lines with men almost exclusively going out to sea to catch the fish and women doing the majority of on-land processing. Most of these workers are seasonal workers. The degree of exposure is likely to be highest during the harvest season when most of the fish processing occurs. The ratio of employment of men and women in fish processing units is 3:10. Estimation of total IgE of women workers revealed that only 12.2 per cent of the women workers had normal level of the total IgE and the rest of them had higher. Majority of the women workers (71.4%) had elevated level of IgE and the mean total level was 960±180.2 IU/ml. This clearly indicates that women employed in seafood processing units have higher IgE levels which may be one of the reasons for respiratory problems and allergic reactions among the workers. Thermographic images of upper and lower extremities of women workers indicate there is a reduction in skin temperature by almost 8 - 10ºC.

Similarly the participation of women in call centre industry has been seen as a critical enabling factor for continued growth of the industry. Call centre has found its place in the service sectors like banking, finance, transport, utilities, education and medical care. The call centre work involves long hours of work, permanent night shifts, incredibly high work targets and loss of identity, which results in several health hazards and increased absenteeism. The workers experience the boss syndrome (Burnout Stress Syndrome) characterized by chronic fatigue, insomnia and complete alteration of 24 hours biological rhythm of the body. This sector will employ a huge number of young workers who would be facing several health risks during their career. Thus a systematic scientific study on health problems of these categories of worker is the need of the hour. Ergonomic analysis of the work environment throws light on the various hazards and risks faced by the women workers and helps in formulating strategies to be implemented in the work place to minimize discomforts and enhance productivity.

Design and Development of Combat Boot: An Ergonomic Approach to Mitigate Risk of foot injuries

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Abstract: The exerted impact forces during daily activities with carrying loads are transferred between ground and human body. The planter pressure is used to quantify the impact force which transmitted to the joints of lower extremities with increased risk of foot injuries during various activities. Military recruits walk about 11 km per day thus absorbs about 351000 N impact forces during carrying of 4.2 kg rifle in hand that increased risk of foot injuries. The existing heavy weight boots without impact force absorbing Insocks to increase possibility of injuries during different activities over long duration. The existing boots also have weight burden in terms of functional features like anti-penetration and slip resistance. Military personnel walked over different terrain that exerts different impact force may cause risk of lower extremi-ties injuries like tissue injuries (muscle strain), fractures, joint dislocations and ankle & knee joints injuries, ultimately reduces their functional efficiency. Under these scenarios, the study was aimed to make light weight boot, constructed on ergonomic principles with improved functional features for different terrains like better shock absorption ability and impact force absorbing Insocks for military application. Objectives were to reduce transfer of impact force to the lower extremities joints, skid, sharp object penetration, over-use injuries and risk of fall.

First, the CAD model of boot was designed. The prototype development and fabrication was done and carrying out for ergonomic study. Efficacy of new combat boot was tested in laboratory field conditions. Ergonomic parameters like Balance, stability, and energy expenditure, kinematics and planter pressure responses measured during walking conditions.

Observations of the present study stated newly designed combat boot decreasing the impact force at various foot regions in both feet in comparison existing one during level and gradient walking. The ergonomic boot improves balance & stability, less energy expenditure and reduces transfer of impact forces compared to existing boots. The sole system with different combinations of materials, injury preventive approaches and easy uses benefits features were found to be enhances efficacy of the ergonomically designed boot. Hence the present study suggested using the newly designed combat boot that reduces all the identified problems; enhance mobility and minimizing the risk of foot-related injuries in long term use.

Key words: Combat boot, Ergonomic design, Injury prevention, Impact force, Balance stability.

Ergonomics Research and Application in Indian Agriculture

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Abstract: Agriculture is one of the most drudgery prone sectors in India, and it is the biggest employer in the country with 263 million human workforce. Traditionally, the human workforce and draft animals were the a major source of power. However, now, other power sources are used in agriculture which include about 7 million tractors, 0.5 million power tillers, and 26 million electric motors/ diesel engines/ pump sets. It is well known that improper work environment leads to injuries, occupational health problems and reduced efficiency of agricultural workers. Therefore, ergonomics research and application can play a large role in agriculture to address these issues.

Ergonomics research in agriculture dates back to 1960's, the pioneering institutions being Presidency college of University of Calcutta, and Indian Institute of Technology Kharagpur. However, it got the real boost after establishment of the All India Coordinated Research Project on Ergonomics and Safety in Agriculture and Safety in Agriculture (AICRP on ESA) in 1996 by Indian Council of Agricultural Research. Absence of anthropometric data of Indian agricultural workers was a major concern for any ergonomical intervention in agriculture. Therefore, the AICRP on ESA carried out a comprehensive programme for collection of anthropometric and strength data of Indian agricultural workers with the help of State Agricultural Universities and other R & D organizations, and the data on 79 body dimensions of 14618 workers and on 16 strength parameters of 9515 workers were collected. Also, a good amount of other ergonomical data have been generated by the 11 centres of AICRP on ESA during last 20 years. The surveys on agricultural accidents revealed that the overall accident incidence rate per year was 333 accidents per 100,000 workers whereas the fatality rate per year was 18.3 per 100,000 workers. It was estimated that each year there might be about 45,000 fatalities and 7,50,000 non-fatal injuries in agriculture costing about Rs. 5,400 crore per year to the nation. Therefore, to minimize this cost as well as to improve the work environment in agriculture, ergonomical design guidelines for agricultural tools and equipment were developed and put in the form of a "Ergonomical Design Guidelines Handbook for Agricultural Tools, Equipment and Work Places" for use of all the stakeholders involved in farm equipment design and operation. To make it easier to understand and adopt these guidelines, regular training programmes have been started by ICAR-CIAE Bhopal for various people involved in the research, design and operation of tractors and other farm machines as well as for teachers and students of agriculture and related disciplines.

It is well known that ergonomics is concerned with improving the performance of a person or person - machine system. Though, there are a large number of examples showing improvements , generally, the results are not expressed in measures that are easily converted into monetary terms. However, now, there is a growing demand for cost–benefit data of ergonomics applications. Considering this aspect, a procedure was worked out to arrive at the monetary benefits of ergonomics application in agriculture through AICRP on ESA, and accordingly, the the same were calculated. This presentation covers in brief the ergonomics research and application work done under the AICRP on ESA in last two decades, and the estimated monetary benefits resulting from this work.

Ergonomics Risk Factots Assesment for Promotion of Safety Health & Productivity at Work

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Abstract: Ergonomics risk factors assessment in shop floor is paramount importance for safety health and higher productivity for industry without injury accident, loss of life. The risk factors assessment is done as per factory act regulatory processes. Some follows every six month interval, many other yearly many does it as and when they feel require. Most of risk factors are manual material handling, awkward postural. Long hour of work, heavy energetic work load, extremely hostile working environment, complex machinery, human psychological state etc. all those factors contribute fatigue in human thus incur higher fatigue also causing higher chance of high risk error and accident.

As of now many tools are available in literature. However, all are not fully satisfactory. Needs more universalization acceptable, easy to use at shop floor. Some cases India have done some commendable research at university of Kolkata, IIT Mumbai, Guwahati, Kanpur, Delhi, and Chennai. Other Indian university has done some scanty work. Similarly Indian council of agricultural Research (ICAR), ICMR, CSIR, RDSO, DRDO, did some work of their own problematic, academic, project etc but industrial application is limited.
The manual material handling assessment is done by NIOSH revised equation JSI index, though very useful have some limitation needs further simplication with more factors to be considered. Presently it is for two hand operation, needs single hand option. Presently hot cold awkward posture, confined space it is not applicable.
Similarly metabolic assessment techniques are full proof it also needs to be rational by each nation. India also needs to do so for national application by doing basic research. Similarly national energy requirement energy expenditure needs to be elaborate in all regions to avoid regional variations.
We are in tropical region of globe thus heat is our main environmental problem. Thermal exposure its ill effect are to be categorise nationally. India is vast country with various environmental prevalence, regional wise. Thus compresenhasive regional studies are to be compiled asses and national conscious of exposure limits are to be determine a for all India application. All our effort will enhance enforcement activity meaningful effective. It will bind to be effective national industrial safety health productivity tool at large.

Many areas are unexplored such as psychological wellbeing of human, Modern complex engineering machineries at shop floor needs accurate technical knowledge to operate. Our industrial population do not have such on job training, education to reduce human fatigue on such complex machineries. Though not directly involve shop floor, but very essential to produce text book in this area. It is very much lack in our country. We need text book, monograms, relevant in this field to educate our industrial population. Few small attempt have done in this area needs more sustain effort. Very good work has been reported in design to reduce static fatigue needs more standards to follow. Paper did not elaborate all others factors in details.
It is in this context I want to invite young generation physiologist ergonomist, psychologist and engineers to do more research, training, to improve confidence to industrial populations. We have many laboratories in Country but focus research is scanty in this area. I am optimistic good work wii come from Indian in future.

Note: Views expressed in the article is of author in no way it reflect the official views of neither govt of India nor central labour institute.

Causal Analysis of Occupational Fatal Accidents through Ergonomics Perspectives

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Abstract: Though no Individual, Industry or Nation welcome accidents, still industries face accidents regularly. ILO estimates that annually about 270 millions employees injured in work accidents out of which globally more than five hundred people per day never return from their work places. But for the last few decades, researchers and safety practitioners have contributed several sophisticated systemic models for effective management of safety & accidents. Then where is the 'Gap'? Probably the gap originates with the non-inclusion of causal analysis of accidents through Ergonomics perspectives along with root cause analysis of human error at the time of accident through in-depth understanding of behavioural science. In other way, there may be a gap of accident analysis concept and the system for calculating the magnitude of accident problem.

Occupational accidents generally happen as a result of a chain of events, in which something has gone wrong. It has been shown that certain human factors intervention may prevent the injury or damage to which such a chain of events would otherwise lead to fatal. Understanding human factors while analyzing workplace risk factors may be a vital part of modern safety analysis system.

A complete and accurate view of the state of affairs with respect to workplace fatal accidents can be evaluated by means of a comprehensive reporting and record keeping system. Analyses of well prepared accidents reports considering all related human factors, can give a picture of the basic relationships for the causes of accidents. Knowledge of the relevant risk factors can be obtained by analyzing the detailed information provided with each accident record as to where workers and operators were located, when the accident occurred, what they were doing or handling, by what means, what damages or injuries occurred and other particulars surrounding the accident including relevant human factors like physical anthropometry & design, Bio-dynamic factors, strength & endurance, Human error and cognitive factors, Health status, Psycho-social factors etc.

Fatal accident analysis is not merely a recording of little basic accident information. In major fatal accident analysis reports, evaluators prefer to highlight the technical and organisational causes of the accident whereas the information of human centred causes of accidents like impaired psycho-physical functions, poor time management, unfamiliarity with procedures, personality factors and much other such vital information are not listed in the final report. Every fatal accident analysis should be a multivariate & multifunctional system of recording the total information regarding the work, the worker/s and the immediate environment of the accident. Present discussions will highlight the missing of some major Ergonomics factors in few fatal accident analysis reports of Indian heavy industries which may be the key contributory factors for fatalities. Every fatal accident analysis report will be a new lesson of safety management for future if we incorporate all the vital human factors failure information at the time of accident.

Keywords: Accident analysis, Fatal, Ergonomics, Safety

Design of the Fingertip Force Sensing System for the Understanding of Pinch Grasp

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Abstract: The activities of daily living performed by the human body result from biosignal information originating from the brain. The upper limb activities, particularly grasping of the objects, occur as a result of such signals: electrical signals; magnetic signals; etc. Besides these signals, the sensory feedback information from the mechanoreceptors is also essential to grasp objects. Thus, sensory feedback information is also helpful in the design of upper limb assistive devices. One such sensory system is the force feedback system required to manipulate the grasp force of the objects. For the creation of such systems, an understanding of human grasping behaviour is also essential.

In this study, a fingertip force sensing system was designed using a force-sensitive resistor (FSRs). Four FSRs were placed on the fingertips from which force required to grasp the object is acquired. This study details the steps followed for the design and acquisition of the fingertip pressure information. The designed sensing system is further used to understand a pinch grasping pattern. An experiment was designed in which an object of different weights was used to perform a simple pick and place task. The weights were varied up to four levels: 200gms, 300gms, 400gms and 500gms. It was found that the whole grasping phenomenon during the pick and place task consists of two types of forces: the lift force and the grip force. The outcomes in terms of lift force and grip force and its grasping pattern are explained in this study. The average grip force and lift force required to grasp an object at different weights were computed. It was found that the gap between grip force and lift force was found high when weight was low. With an increase in weights, the gap between the two types of force is reduced.

In future, similar correlated studies will be performed for different finger combinations. It is expected the findings of these studies will be used for the design of the force feedback system required for a assistive device.

The New Liberty Mutual Manual Materials Handling (LM-MMH) Equations and Other Recent Developments in Physical Ergonomics

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Abstract: This webinar will describe the development and applications of the new Liberty Mutual MMH Equations, summarizing the 9 psychophysical studies incorporated into the Snook & Ciriello (1991) lifting, lowering, pushing, pulling and carrying tables, as well as the 12 studies published later. Examples will be provided for a free Excel app.

The webinar will also present data challenging the validity outputs for manual arm strength from most digital human models and describe the development of a new assessment tool for work done above the shoulder

Ergonomic Evaluation and Designing of Chisel – A Hand Tool of Carpenters

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Abstract: A large number of carpenters are involved in furniture making, constructing and maintaining residences and buildings in India. The jobs of the carpenters are physically strenuous and demanding. The workers have to do lifting and pulling activities and they are also required to manage heavy equipment and objects. Carpenters use different kinds of hand tools, e.g., chisel, saw, carpenters plane, drill etc for performing different carpentry tasks. Some of the tools are of conventional type lacking human factors in their design and may have incompatibility with user particularly at the level of hand-handle interface. This may lead to aches, pain and musculoskeletal disorders.

The main objective of the present study was to evaluate the chisel, a frequently used hand tool of the carpenter, and redesign the same considering the human factors.

The prevalence of musculoskeletal problems of the carpenters was evaluated by Nordic questionnaire method. A user's satisfaction survey was employed to find the level of compatibility of the hand tool with the carpenters. An anthropometric survey was done to study the degree of mismatch between the hand dimension and the chisel. Different design concepts were developed to overcome the problems of the conventional tool. Some prototype models were made according to the design concepts developed. Paired comparison tests were conducted to optimize different characteristics of the chisel. The design of the chisel was modified by considering the results of the paired comparison test and anthropometric dimensions of the users. The modified hand tools were assessed by studying the occurrence of pain/ discomfort , working heart rate and productivity study.

From the results it was noted that the prevalence of MSD was high in lower back, wrist joint, fingers and palm of the chisel users. Evaluation of existing chisel showed that main problems of users were associated with back and hand-arm systems. A large percentage of users reported about the origin of problems that might be due to repeated use of chisel. Keeping all these in minds, efforts have been made to redesign the chisel used in different tasks of carpentry. Two design concepts were developed in which some modifications were made and some new characteristics were incorporated. The length of the handle of the chisel was increased from the existing length. Some of the physical dimensions of the chisel handle (diameter of the handle) could be selected by taking the percentile values of anthropometric data of the users. Diameter of the handle was decreased from existing chisel. The shape of the handle was changed from existing chis-el. It was suggested to incorporate rubber pad in the grip area of the handle. In the second concept it was suggested to provide a better grip in the hand tool so that the operators can hold it firmly and comfortably and slippage can also be avoided. Each of the design criteria was selected by subjective preference of the users employing paired comparison test. Some prototypes were made according the developed design concepts. The percentile values of some hand dimensions were determined and those were utilized in designing the tool. Paired comparison tests were employed to optimize different physical dimensions characteristics of the chisel, viz., diameter, length, shape of the handle and type of grip on the handle.

Continued in Next Page.

The handle length and diameter was fixed with percentile values of hand breadth and hand grip diameter respectively as well as the results of the paired comparison tests. The shape and additional grip of the handle were selected from the results of the paired comparison test. In upper part of the handle a safety guard was fixed to ensure the safety of the workers during operating the tool.

The modified chisel was assessed by studying the incidence of pain and discomfort in different segments of the chisel users while working with the modified and existing hand tool. It was observed that the occurrence of pain / discomfort was significantly lower in case of using modified chisel. The working heart rate and cardiovascular stress index were found to be decreased while working with the redesigned tool. The productivity was slightly increased in case using modified chisel.

The results of the productivity study, heart rate study were in favour of the modified model. The cost was little higher in modified chisel than existing, but it could be affordable by the owner of carpentry company. On the other hand, the modified chisel had lowered the risk of injury among chisel users and provides better work comfort. Decrease in the occurrence rate of injury would obviously reduce the expenses on medical treatment and compensation of the chisel operators due to musculoskeletal disorders and increased the safety of the system. Thus in a long term, modified chisel would be cost effective and a best value model.

Standard Indian Jewellery Workbench - Applied Ergonomics in the Domain

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Abstract: The Indian Standard Workbench is an ergonomically designed precision engineered jewellery manufacturing workbench, crafted in perfectly seasoned beechwood. It takes into consideration more than 20 anthropometric measurements and has scope for height adjustment according to different body forms and the user's preferences. It also takes the Jeweller's Microcosm into consideration and creates a healthy work envelope around the user.

Owing to the aforementioned features, this bench manages to prevent neck pain, back and lower back pain - physical health problems that are frequently experienced by workers on a jewellery shop floor. It presents itself as a fine example of an ergonomics based product, and hence is being extensively used in the industry.

The build of the top allows for free hand movement while working and increases accessibility to tools - leading to a cleaner bench top and a significantly more organised workstation. This enables the user to have more mental clarity during physically demanding work hours and makes it easier for them to follow a systematic and well defined manufacturing process. A properly screwed bench pin on the gooseneck prevents craning of the neck during production and makes work more pleasant, leading to an increase in both the efficiency and quality of work. Moreover, the benchpin is customisable and can be drilled into, depending on the requirements of a project and can be replaced as and when required. The vertical drawer on the side for additional storage is another useful feature which adds to a holistic work envelope which this workbench aims to achieve. It allows the user to switch between temporarily storing the tools inside the drawer or on the benchtop as per operational requirements. The adjustable feet account for any potential level distortion that might hamper smooth production due to an uneven floor.

Post work wear, the top can be serviced to help it regain it's uniformity and flatness and retain it's quality and the bench even provides a plate to keep track of the level of servicing that the product has undergone. The workbench is designed for convenient transport, it is a flat pack design and is easily serviceable. It is a sustainable product since it does not add to any plastic waste piles, and the fasteners and supports used can be reused and upcycled during the manufacturing of the next bench.

The duty cycle of this product is long, and easily manages to deliver optimum performance for 15 years. Post the exhaustion of its service life, the bench can be used to retrieve precious metal dust that it would have gathered over years of use without leading to irretrievable losses, thereby adding monetary benefits for the establishment.

Motorcycle Design Ergonomics

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Abstract: Motorcycles have been in use for over 150 years and have evolved into various forms across the world. However, there is limited research on design-ergonomics of motorcycles. India being one of the largest markets for motorcycles in the world provides an excellent opportunity for research on motorcycle ergonomics. The aim of this talk is to provide an overview of motorcycle ergonomics covering the state of research and case studies from an industrial perspective. The talk will begin with an introduction to physical and cognitive ergonomics for motorcycles and present the areas of application in the design and development. The talk will cover details on aspects like posture design & comfort, seating comfort, haptic feel, readability of clusters & mirrors to name a few. The talk will be useful for researchers and students interested to understand the problems and scope of work in the area of motorcycle design-ergonomics.

Female Bone Health - Exercise and Aging

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Abstract: Bone is that part of the body which is dynamic in nature as its role in the body is both mechanical as well as haemostatic. The process of remodelling of bone occurs continuously in the body and replacing it with the new ones and the distinct areas from where it is done are known as bone metabolic units (BMU) (Riggs et al, 2002). Remodelling of bone depends upon the body needs such as specific physical needs related to work or routine or needs to maintain balance and weight bearing which can alter bone ar-chitecture (Hadjidakis and Androulakis, 2006). With aging this resorption process shifts in a negation di-rection leading to bone mass deficiencies and reduction in the strength of bones (Demontiero et al, 2012). It has been observed that the bone loss with aging is a complex process which involves many extrinsic and intrinsic factors. All the factors which include genetic, hormonal, biochemical and environmental, are col-lectively responsible for the bone mineral loss with aging. Above all aetiology of low bone mineral density and poor bone health observed that the female gender being more prone to geriatric bony changes. With aging the hormonal changes experienced by females leads to the loss of bone health. Hormonal insufficien-cies like low estrogen level hinder thin bone turn over as estrogen is a key component to initiate this turn over. But exercise plays a key role in developing bone strength. Regular exercise stimulates the bone to grow stronger. As the muscles grow and get stronger with exercise, the bones also behave the same. There is a common saying for bones and joints that “use it or loose it” Regular physical activity helps to maintain bone mass and reduces the age related bone loss.

Keywords: remodelling, estrogen, geriatric etc.

Human Factors and Behavioural Design

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Abstract: Design for behavioural change is the recent trend of design in which researchers are thinking about various strategies to persuade various tasks done by the target population. Also, behavioural design is now a very relevant topic of discussion in the field of user experience design. In this context, various human factors such as emotion, attention, and motivation play important role in persuasive behaviour. The instructions, awareness programme, reward, punishment, penalty, competition, gamification, visual attractiveness, and visual chaos are a few of the strategies for behavioural change among targeted users or the target audiences related to aforesaid human factors. For instance, the allocated rewards for a task evoke happiness (as an emotion) and motivate the user to pursue a task, penalty or punishment prevents people to pursue a task, high attentional demand might delay the click behaviour on a close button for an online advertisement, etc. In addition, application of design elements, design principles, and human touch might also have an influence on behavioural change of the target population. In this study, a behavioural design framework has been developed based on relevant human factors to practice behavioural design. The behavioural designers and managers can apply this framework for the betterment of user experience, management of the human population and to achieve desired task goals.

Keywords: Behaviour; Emotion; Human Factors; Motivation; Persuasion; User Experience

Digital Technology and Artistic Skill in Creative Production: Respect of Animation Entertainment Platform

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Abstract: Day by day digital technology developing like software, media etc. It's true that in animation production without digital technology, artistic skill and creativity, it is not possible to run the entertainment world. Discussion with the industrialist and academic personalities it has been found that, now a day's software adapting process is gradually increasing but somewhere individual skill and creativity are not getting encouraged. In this research it has been tried on how technology and software can provide a set of rules, which can nurture the inbuilt skill in the individual. Through this way new comers in the industry as well as the learners of this entertainment creative field will get proper creative platform which will provide them perception and cognitive experience in animation entertainment field.

Keywords: Entertainment, Digital media technology, Artistic skill and technique, Animation, Creativity, Perception

Enhancement of Construction Workers' Safety by Controlling Ergonomics Hazards using Internet of Thing (IoT)

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Abstract: Major construction jobs are labor centric in spite of considerable development of construction equipment industry. Thus, excessive labor efforts to various construction activities results increasing threats of safety, concern about human ergonomics associated productivity and human error issue in construction execution phase specially. This challenges are mainly due to lesser availability of real time information of construction worker and project specific environmental information. In some complex onsite jobs workers need to exceed their physical capability to perform assigned task however, such repetitive actions are responsible for strain injuries and other musculoskeletal disorders.

This issue can be effectively address with the implementation of Internet of Things (IoT) into construction sector. The sensor based technology offers real time monitoring of construction labors safety and ergonomic hazard for construction activity. However, this vague information updates can be gathered through the applications of smart devices, sensor; Radio Frequency Identification (RFID); smart networks into construction activities at smaller scale to the entire project scale. These connected devices can communicate with each other on real time progressive development of activity or project thus act as a yardstick to manage project in a best possible manner for the managers and engineers. Adoption of this futuristic technology requires a collaborative efforts from different engineering discipline to have impeccable operational success.

In country like India where majority of workers are working in an unorganized sector adoption of such IoT tools may posing number of challenges nevertheless results of such implementation may significantly reduce threats of safety, concern about human ergonomics associated productivity and human error issue by providing real time monitoring of construction workers.
However, in spite of having number of significant merits, the construction sector is not aggressive to adopt IoT technologies for labor centric jobs. Very often construction project stakeholders are in dilemma about implementing such modern tools due to lack of real time knowledge and experience to deal with technological instruments effectively.

Respiratory Symptoms in Brick Kiln Workers: A Pre–COVID 19 Study in Indian Unorganized Sector

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Abstract: Brick kiln workers are exposed to respirable suspended particulate matter (RSPM) and are susceptible to multiple pulmonary symptoms. Here is investigation of occupational exposure to RSPM and lungs function parameters of brick kiln workers.

The study included both male and female subjects for the qualitative assessment of respiratory symptoms followed by quantitative assessment of occupational to RSPM and lung function parameters; FVC, FEV1, FEF25-75, PEFR, PIFR using spirometry. The data were analyzed using paired sample t -test.

The mean RSPM in firing, mixing & molding sections are significantly higher than the permissible exposure limit of 5 mg/m3. The lung function parameters were significantly lower in exposed (male and female) workers than the controls at (p value < 0.05). Also the lung function parameters such as FVC, FEV1and FEV1/FVC% were lower in females with aged > 30 years than the younger group.

The brick kiln workers are at high risk of developing obstructive and/or restrictive respiratory symptoms affected by duration and type of the job and lack of use of PPEs. Study recommends strict enforcement of occupational health protection and labor law along with suitable ergonomics and technological interventions.

Keywords: Respiratory health, Pulmonary functions RSPM exposure, brick kiln industry, Unorganized sector.

Ergonomic Framework to Mitigate Physical Risks in Manufacturing Industry

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Abstract: Ergonomics is concerned with designing jobs, tasks, and prod-ucts for safe and comfort human interaction. In broader sense, ergonomics incudes physical, social, and cognitive aspects of work and workplace de-sign. In developing nations like India, importance of ergonomic principles is less realized in manufacturing industries taking backstage after produc-tivity. Out of all the activities, manual tasks are inevitable in these indus-tries. Workers perform it, most of the time, in their workday and exposed to high physical risks. Systematic assessment of these risks will help to identify bottlenecks, its origin for developing a framework to mitigate those risks. Assessing these risks includes postural observation, dis-comfort measurement, analysis of workplace risks, work effort and fatigue, as-sessing biomechanical ele-ments like lower back, upper and lower extremity. In this study, a framework has been developed to as-sess the physical risks at a workstation. Workers subjected to repeated tasks of loading and un-loading heavy components participated in the study. The workers reported persistent pain, thereby causing dis-comfort, fatigue, and permanent disor-der. NIOSH lifting equation, RULA and biomechanical risk as-sessment tools were used to identify the bottlenecks at the workstation. To mitigate the physical risks identified at the workstation, a lifting aid has been de-signed and fabricated. It has been observed that use of the lifting aid at the workstation significantly reduced the load at lower back, upper and lower extremi-ty. The same framework has been applied at different workstations to mitigate the physical risks.

Keywords: Physical risk, human fatigue, ergonomic framework, RULA

Assessment of Postural Discomfort in Present and Modified Drilling Methods

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Abstract: Manual workers performing various types of tasks have reported work-related musculoskeletal disorders (WMSDs) resulting in loss of working days. Annually 270+ million people get inflicted with occupational injuries. WMSDs have been shown to be one of the major reasons of work loss equal to ten million working days every year in United Kingdom (OSHA, 2012). Similar scenario exists in USA. The statistics given by the Bureau of Labour Despite the fact that new technological developments have paved the way to design and propose automated/improved work methods for manual tasks operators, manufacturing scenario in the world revolves around manual working. Some of the tasks like drilling, milling, turning, sheet metal fabrication etc. are performed manually in all developing and underdeveloped countries. It was revealed that 80% of the workers engaged in manual working had their involvement in 90% working establishments in developing nations. Also the level of risk depended on the intensity of work, frequency of task to be carried out and task time. Drilling was one of the tasks that could result in awkward posture, repetitive arm movements, prolonged standing and above shoulder height working. The work posture which is positioning of various body parts, if inapt, results in discomfort. This inaptness becomes the leading cause of MSDs.

In the present investigation, the effect of standing and perched postures on discomfort in various parts of the body during the task of drilling was studied. Two drilling methods namely present drilling method (PDM) and modified drilling method (MDM) developed by Khan and Muzammil (2018) were evaluated. The computerized OWAS method, along with Corlett and Bishop Methods, was used to estimate discomfort. The Kinect motion sensor (for Xbox 360) was utilised to capture postural images. Thirty subjects selected for the study were all males, healthy with no previous history of any kind of musculoskeletal disorder. All the subjects selected were not having any industrial experience to their credit. The independent variables selected were age group, the drilling method and the working posture while the dependent variables were the global risk. The task was to drill a mild steel block at a constant speed of drilling. The subject performed the task for duration of two minutes. The Kinect sensor captured 480 frames for each subject. Ergonautas-NUI software was used to retrieve and process the data obtained from Kinect sensor. The data collected on posture frequency in various risk categories was normalized for each experimental condition. A univariate ANOVA was used to analyse the global risk rating and average VAS discomfort scores. The results of the study showed that the standing posture in PDM resulted in highest number of risk postures while the perching posture in MDM has the lowest number of risk postures. The degree of risk was within the satisfactory limit when the task was performed in perched posture with MDM. A significant reduction in the worker discomfort was observed when the task was performed in a perched posture using MDM.

Design Elements in Education Toys in Usability Perspective

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Abstract: Children perceive by using their senses to gather and understand information and respond to the world around them by cognitive effort. Perception, attention, memory, and thinking are all interconnected mental processes in human cognition. The ability to perceive surroundings through the light that enters the eyes is called visual perception. Visual perception in children is an essential ability of their brain to connect and make sense of what their eyes see. The visual perception of colours, patterns, and structures has been an essential factor concerning a product because these are perceived exclusively through vision. Good visual processing skills benefit reading, writing, math, and other essential aspects of learning. As children in their preschool days learn from educational toys, the designs of the educational toys should consider enhancing their learning. Additionally, educational toys have become one of the tools used to teach children in many aspects, bit by bit. Research shows that learning through play is an integral part of a child's development. Cognitive skills developed in the early stage of life and use of educational toys can enhance these. Educational toys help children develop fundamental abilities such as cognitive thinking and problem-solving. Since toys are essential for the development of children, the National Education Policy of India has given the focus on toys and the enhancement of local toys. Moreover, learning while playing has been made a part of the curriculum. However, for manufacturing such effective educational toys, the manufacturer has to consider various factors like safety, colour and shape and other design factors that enhance their development. Therefore, it is necessary to identify the effects of design parameters of educational toys in children's learning.

Keywords: educational toys, design elements, cognition

Ergonomic Issues in the School Environment for Enhanced Productivity

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Abstract: School premises are an important place where the child learns and grows. In the Indian context when it comes to majority of the primary schools in rural and semi urban areas, the students have issues of pain in different parts of the body, lack of attentiveness, lack of interest in studies etc.

The objective of the current study was to probe into the ergonomic issues in the school environment and suggest feasible ergonomic solutions, which would address these problems.

Direct observation and activity analysis, questionnaire study, body part discomfort mapping, measurement of environmental parameters and anthropometric analysis were done.

The investigation was done on 58 primary school children and 193 primary school teachers. Only 35.7% of the schools had playground. 28.57% schools had both playground as well as indoor games facilities. Only 19.04% schools had facilities for indoor games and the children had no option of going out and play in fresh air. There were anthropometric mismatches noticed between the children's body dimensions and the dimensions of the furniture in the classroom. In many places, students were forced to seat on the floor in a forward bending posture leading to low back pain. The illumination level inside the classroom varied from a low of 40 lux to 1300 lux. The mean body part discomfort on a five point scale indicated a very high value in the neck(4.1). wrist and forearm(4.3) and lower back(4.3) region.

The results so far indicate the need for immediate ergonomic intervention in the area of classroom layout and furniture design along with placement of luminaire at strategic places for better illumination. There is also a need for proper visual ergonomic design intervention to make the place more lively and attractive to the students.

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Mumbai Dabbawalas: Strategy for a Sustainable Business

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Abstract: Mumbai Dabbawalas are world famous for their service in food delivery space that has sustained for more than 130 years. It all started in late 1880's when Havji Bachee, a young man from Pune entered Mumbai, looking for job where he was employed by a Parsi banker to bring tiffin from his home and deliver it to his office. This is where Bachee identified the opportunity to fill this void which was created by the working-class Indians, as they wanted to eat fresh and hot meals, and couldn't find time to go back to their home for lunch. Bachee pitched the idea to his fellow villagers, to which they agreed, and the Legendary Mumbai Dabbawala emerged. With time, the business has captured attention of many famous people like Dutch Queen Maxima, Prince Charles, Richard Branson who visited India to meet these people. The organization has also found mention in Forbes Business Magazine, Harvard Business Review, etc. for the extreme capability of Mumbai Dabbawalas to deliver millions of meals in right place, on right time and also handling the reverse logistics, all this handled by semi-literate employees using a bicycle and the network of Mumbai Local Train to get the work done.

Also, in the last 10 years, there has been a rapid rise in online food-delivery space. Many players emerged, few sustained while few collapsed, the current market being predominantly dominated by Swiggy & Zomato. PAN India orders per day hover around 2 million, testifying to the fact that there has been a huge cultural and behavioural change in the country. These companies are mostly associated with main-stream restaurants, which always have the outside food flavour, but the difference with Dabbawalas is that it delivers home cooked food at workplace on a daily basis.

Pandemic had shut down the offices and put Mumbai's renowned Dabawalas out of work and resulted in a huge loss of livelihood for the group. In recent times, with the world and India taking digital leaps, the Dabbawalas too have found the need to embrace technology and offer click-based services.

Keywords: Dabbawala, logistics, pandemic.

Occupational Health, Work Pattern and Psychological Factors Association with Accidents Occurrence Among the Non-Government City Bus Drivers of Kolkata

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Abstract: Public buses in Kolkata are the backbone of the local transportation for the common man in the city. The objective of the study is to investigate the association among the work pattern, physiological, psychological, work environment factors of the drivers and their association with the occurrence of accidents.

The study was undertaken among 118 randomly selected bus drivers from different routes. To assess the musculoskeletal and accident analysis questionnaire was performed. The associations between individual characteristics and different factors were also examined by a χ^2 test and the associations were described by the odds ratio with 95% confidence interval.

Drivers work for 16-18 hours per day. Questionnaire analysis reported that 10.9% have MSD. Study also found a significant association between accidents with MSD (4.8, 1.1-21), hearing loss (6.9, 1.7-23.9), monotonous work (5.9, 1.9-17.9), prolonged working time (3.3, 1.2-9.1), inadequate rest periods in between the working days (4.1, 1.3-12.1) and monotonous work (2.7, 1.1-7.7), inadequate rest period during the working day (5.1, 1.3-1.6), poor job satisfaction (5.9, 2.1-17.1) and low job appreciations (3.3, 1.2-9.2) showed a significant effect on the occurrence of accidents. In spite of the above fact, the results reveal that the majority of the near misses occurs as a result of the driver's fault that include competition between buses, failure to maintain maximum safe distance and fast overtaking.

The bus accidents are related to occupational and psychological stress along with excessive hours, poor road design and ignorance and violation of traffic rules.

Keywords: Questionnaire; Musculoskeletal Disorder; Near Miss Cases; Discomfort; Back pain

In Search of Novel Predictors of Aggression Amongst Pre-Pubertal Children of Bengal: An Attempt of Facial Anthropometry Assisted Clinical Bio-Chemical Assessment

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Abstract: Introduction: Aggression is becoming a growing trend amongst the individuals of the young age day by day. It is believed that characteristic changes of human being towards kindness and compassion can only be done at early age.

This particular work aims to eradicate cruelty from those mal-treated parts of the society where fake social cultures, myths and disbelief, nurture negativity among children from 5 to 12 years, which were considered as the subjects for this cross-sectional study and to find out novel predictors of aggression.

Facial anthropometry, 2D/4D ratio, cognitive ergonomics and biochemical assessments were done. About 200 children (boys and girls) of both primary and secondary growth spurt were randomly chosen from schools of West Bengal. They were distributed in three different age groups namely: pre-pubertal, intermediate and post pubertal. 2D/4D ratio and aggression score by Buss-Perry aggression questionnaire, Facial and physical anthropometric parameters, biochemical parameters, Serum BDNF, Cortisol, 2D-4D ratio and daily nutritional records were taken and assessed statistically. Extensive clinical & nutritional interventions were performed on subjects.

From the results of pre-intervention it appears that Waist-hip ratio, Waist circumference; Britageon breadth, En-Ex, serum Testosterone level, Physical aggression and Anger scores were found to be significantly different amongst the aggressive children of 5 to 7 years. And 2D/4D ratio and serum BDNF level is found to be significantly different amongst the aggressive children of delayed secondary growth spurt or 10 to 12 years. Serum BDNF levels were found to be significantly correlated with neck circumference, verbal and physical aggression of secondary growth spurt. On the other hand, serum Cortisol level was also found to be correlated with 2D/4D ratio. Obtained data from the control subjects falls upon the angle of Q-Q plot whereas the non normal set remains scattered for all the biochemical parameters. Type II MANOVA also showed some major findings that the five facial landmarks of Farka with 2D/4D ratio, can predict the level of serum BDNF at pre puberty, where as 2D/4D can be the key predictor for stress hormone for the children of post puberty.

During primary growth spurt , amongst all the parameters testosterone level was found to be the major determinate of their moods and attitudes, while in delayed secondary growth spurt (10 to 12 years), instead of testosterone level serum BDNF and Cortisol levels are considered to be the major determinates of their aggressiveness.

Keywords: Aggression, BDNF, Facial Anthropometry, 2D/4D & Cortisol.

Wellbeing During Lockdown and New Normal Life Style: Ergonomic Perspectives

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Abstract: Impact of COVID-19 is inescapable encompassing physical and psychological well-being. To mitigate the risk of infection home-confinement and self-isolation are the key measures which has altered global work practice. With unprecedented changes coming on so quickly, it's understandable that the importance of healthy living is flying under the radar as we adjust to new normal life and facing challenges.

To explore the impact of COVID-19 induced lockdown on different occupational groups of India emphasizing psycho-physiological health, we had conducted both online as well as offline study using structured questionnaire on: 1) individuals engaged in the urban corporate sector, performing a '9–5' work while confined at home, rural agrarian workers , police personnel , healthcare workers and students. We had aimed to evaluate sleep-wakefulness behavior, stress-anxiety-depressive symptomatology, screen exposure, somatic pain and discomfort, and other physical health predicaments.

Our study participants involving police personnel, healthcare workers, office goers', rural agrarian workers and students revealed erratic sleep behavior, a shift of mid-sleep time, an increased stress, depression and anxiety affecting the chronobiological milieu, leading to host of physical symptoms. Findings revealed improper work schedule with awkward posture, enhanced screen exposure, chronic somatic pain among respondents. Hence, proper ergonomic analysis and designing of work-rest schedule, mental and physical synchronization are the key issues for better health and well-being in new normal life. So far, our study provides insight into the fact that pandemic induced contretemps must be considered in developing and implementation of interventions for societal well-being.

Ergonomic Design Intervention for the Indian Industries

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Abstract: The Department for Promotion of Industry and Internal Trade (DPIIT) has formulated and implemented several policies as promotional and developmental measures for transforming the Indian industries into a major partner and player in the global arena. The Confederation of Indian Industry (CII) firmly believes that design, innovation and growth are linked and the value of design stretches across all industries and sectors – from manufacturing to services. Thereby, design is the key for India to succeed in a constantly changing globally competitive world. It has also been proven that businesses that use design innovate more often, more effectively and compete less on price.

A National Committee on design was formed by CII to initiate different activities to promote the use of design as a tool for business competitiveness and innovation. In 2015, CII carried out a nationwide study on the Indian Design Sector to understand the relevance of Design industry for the country and its economic and social development with an attempt to devise policies to help the industry and the India Design Council to take up relevant issues for the development of design industry. It was observed that companies that integrate design at the highest strategic levels are more successful than those that do not. Yet only a very few organizations use design at this level.

Ergonomics and Human Factors, one of the decisive components for the user-centred innovation and design is now-a-days getting more importance and is frequently practiced not only in design-schools in India but also in manufacturing industries. In April 2018, the "Innovations for Defence Excellence" (iDEX) initiative was launched by the Government of India, with the aim of fostering innovation and technology development in defence and aerospace by setting up the iDEX network as independent "Defence Innovation Hubs". In parallel with iDEX, the Defence R&D Organisation (DRDO) has launched its "Technology Development Fund" (TDF) to encourage and fund participation by domestic industry, especially MSMEs, for meeting the requirements of the three services.

The National Institute of Design Ahmedabad was established by the Government of India to fulfil two goals – imparting design education, and at the same time providing design services to the Nation. From the very beginning, Client servicing has been an integral part of NID's activity. Through the Integrated Design Services (IDS) NID undertakes consultancy projects from various government, semi-government and private organizations and professionally deliver design solutions in diverse design domains ranging from Industrial Design, Communication Design, Textile/Apparel/Lifestyle Accessory Design and IT Integrated Design.

NID Ahmedabad has carried out several design interventions for the Indian Navy, DRDO labs and for industries manufacturing for the Ministry of Defence. Some of these projects are designing interior spaces for habitability for the vessels, warships, MCP shelter and Troops compartment of ICV Abhay; aesthetics and ergonomics enhancements on airborne winch system and Human Machine Interface for the next generation sonar system, etc. Several workshops were conducted on ergonomics for the design and production engineers of GRSE, Kolkata, MDL, Mumbai and R&DE(E), Pune, etc.

Keywords: Ergonomics, Defence Industry, DRDO, Design Interventions

Ergonomic assessment of hand related occupational pain symptoms among Bagh hand block print artisans of handcrafted textile industry of Madhya Pradesh, India

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Abstract: Bagh hand-block printing is a handicraft textile printing technique originated from Bagh a place in Dhar district of Madhya Pradesh, India. Wooden hand blocks of different sizes carved with motifs were dipped in organic dye and are repeatedly hit against fabric for the uniform transformation of the dye of the motif over the fabric to form designs. This printing process is highly repetitive and involves precision job. The artisans used their hands as hammer to hit the blocks causing chronic mechanical trauma to the ulnar side of the palm. This study aimed to determine the prevalence of work-related hand symptoms, to identify ergonomic risks and musculoskeletal disorders (MSD) and evidence of mechanical trauma among the artisans working in Bagh print of Madhya Pradesh. Occupational risk involved among the artisan's wrist area were identified with the help of Modified Dutch Musculoskeletal Questionnaire (MDMQ) and Boston hand evaluation questionnaire. Boston hand evaluation questionnaire helps in the measurement of the severity of the symptoms. A direct observation study was also performed to identify the chronic effects of mechanical trauma on the artisan's hands. Symptoms like pain, weakness, numbness, and tingling were highly predominant among the artisans. This study supports the evidence that the new artisans are at higher risks of reporting pain and chronic effects of mechanical trauma, including fever and body pain, ultimately causing job loss.

Keywords: Hand block printing; Musculoskeletal disorder of hand; Skin dermatitis; Callosity; Wrist pain.

Section- B
Abstract of Full papers

Designing Cannula Cover to Avoid Infections in Central Venous Catheter

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Abstract: While treating patient at end stage renal disease (ESRD) or chronic kidney disease (CKD), doctors opt for dialysis or transplant depending on criticality of kidney infection. A thorough study of hemodialysis using central venous catheter has been done in this paper. There is very crude method used to cover ports and limbs of central venous catheter. Due to this, patient faces lots of problems, such as water contact to the body part is to be completely avoided. So, patient cannot take bath and it also obstructs the routine activities. In addition to this, it is also susceptible to infections. Sometimes, body part gets infected through which central venous catheter gets inserted into patients' body. Eventually, it increases complications to doctor while treating the patient. To resolve this issue, a product is developed to cover the port and limbs of catheter so that patient will be able to perform his daily activities with ease. Before finalizing the working prototype, different ideations were tried and tested. Through Human Anatomical study has been done before finalizing the design, so that it can be fitted anywhere on the body. This study provides a feasible solution to problems faced by doctors and patient while using central venous catheter (CVC) during hemodialysis. The current work deals with innovative techniques in the management of ESRD and CKD.

Keywords: End Stage Renal Disease (ESRD), Chronic Kidney Disease (CKD), Central Venous Catheter (CVC), Hygiene, Ports, Limbs.

Redesigning the Basket Support for the Tea Plantation Workers - Occupational Safety and Health Design

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Abstract: The purpose of the project was to study through design on the ergonomics of the tea leaves plucking workers in hilly terrain and to find a suitable design intervention to reduce their load and improve their ergonomic conditions. The situation was studied from a design perspective to understand their movements and actions throughout the day, including the loading and unloading of the basket. The study uses User interviews, a Guided tours, day-in life, and role play as the research tools. Having been worked in terrains of changing angles, the workers in tea plantations still continue to use the traditional make-shift design of carrying the plucked leaves on their heads in baskets. Weighing approximately up to 30-40 kgs, these workers navigate through the thick shrubs of the tea plantation balancing the entire weight on their head throughout the day. From an ergonomic point of view, the standards were studied and compared with the real situation to emerge with the most optimal solution. A simple and replicable design solution was suggested to help carry the basket with the least interference to their number of steps-in-action or their existing resources. Special consideration was kept to make the design easily replicable with locally available materials and cost-cutting. Designers and design researchers can use these findings as a foundation for an ergonomic change in the design of the basket as a means to develop a healthy work environment, reduce occupational hazards, increase productivity and improve the work-life of the workers.

Keywords: Occupational Health, Ergonomics, Local Design.

Engaging Design Projects: a PBL Framework for the New Normal Communication Design Education

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Abstract: Communication Design has witnessed novel approaches and methods of teaching learning in context of the new normal needs. Project Based Learning (PBL) courses in Graphic Design have seen novel hybridization formats to explore with other design disciplines. In the new normal times, graphic design (communication design students) at NID Ahmedabad could undertake 'Engaging Design Projects' based on Blended teaching-learning methods, such as: Individual/ Skill-Based Rotation Blended Learning, Flex Blended Learning, Flipped/ Remote Blended Classes and Supplemental Learning Activities as part of the instructions-cum-exchange format for two 'Design Projects' modules conducted by the researcher for her M.Des students of Graphic Design at NID Ahmedabad (2020). Each student took forward his/her core strength areas among design domains in graphic design, such as: Storytelling, Illustration, Indigenous Letter Design/ Indic Typography, Digital Content Curation and Design, e-book-making, Strategic Systems Design, Navigation and Image Building, Branding Local Spaces/ Ventures, etc. The project outcomes showcase a process-to-solution journey presented and reviewed in three project reviews organized and final documentations submitted for each of these Design Projects. The present paper proposes a PBL framework applied that is constructed of 4- Pillars: Pitch, Process, Product and Performance. Each pillar includes blended teaching-learning methods, core strength areas and the respective learning outcomes; and the assessment approaches developed in conducting these Engaging Design Projects. This PBL framework envisions future opportunities of Blended Learning for Engaging Inter-disciplinary design projects for developing project-based learning cum instructional design pedagogy for communication design education.

Keywords: Design Projects, Project Based Learning (PBL), Engagement Methods, Communication Design, Blended Instruction, Design Education.

Design of Personal Protective Wear for Disabled People: An Improvisation on Ergonomics

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Abstract: Post- pandemic the need for inclusive design in personal protective wear was essential to accommodate people of various disabilities. The implementation of universal design will help us reach versatile and flexible outcomes. The designs will be an explosion to create an inclusive society. Universal design aims at the inclusivity of the entire society and is designed to minimize the number of people excluded from using a design. The paper seeks solutions to support and facilitate as possible, to assist people to achieve their utilitarian and ergonomic goals through universal design for personal protective wear. The analysis is done on its ergonomics, aesthetics, and utility factors. The paper proposes solutions based on universal design principles by analyzing constraints in using regular personal protective wear. The proposed design solution aims to achieve the ergonomic and aesthetic factors of personal protective wear for differently-abled.
Keywords: Universal design, Personal protective wear, Ergonomics, Disability

Innovative Ergonomic Product Development Process by Incorporating TRIZ into Human-Centered Design

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Abstract: Modern markets desire innovative products and comfortable usage. Evidence revealed that a lack of methodology is to develop an innovative human-centred product. Human-Centered Design (HCD) was used to develop comfortable products, whereas Theory of Inventive Problem-Solving Technique (TRIZ) was used to develop innovative products. Hence, this study aims to develop an integrative methodology using the HCD approach and the TRIZ technique. The report demonstrates a new method, named Innovative Ergonomic Product Development (IEPD), which describes a systematic process to develop an innovative ergonomic product. The effectiveness of the developed IEPD methodology was ensured by a case study using industrial container design in the textile industry. Using IEPD methodology, a novel design was developed for an industrial container which ensured the innovation and ergonomic aspects. IEPD methodology helps researchers and/or practitioners to develop innovative ergonomic products systematically. The findings of the study help industries to develop innovative human-centred products.

Keywords: Human-Centered Design; TRIZ; Ergonomics; Systematic product development; Industrial container design.

Ergo-Studio – A case-study on Teaching and learning Ergonomics in a Studio Mode

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Abstract: This case-study describes how a lecture-based Workspace Ergonomics course was transformed into a learner-centered Ergo-Studio that engaged with theory through the praxis of prototyping. The goal was to create a learning 'space' that invited students to actively participate in meaning making while providing a flexible structure for guided discovery. The paper introduces the context, describes strategies adopted for the transformation, and concludes with learnings from the experience.

The following strategies were adopted to catalyze the active learning experience. First, real-world contexts that engaged with concepts relevant to the course were identified. Second, course timelines and student deliverables were prepared in advance. Third, a flipped-classroom model for content delivery was used. Fourth, there was a bias towards learning by prototyping. Fifth, students actively shaped their learning experience through research, design, prototyping and testing. Sixth, students self-organized into teams, delegated roles and responsibilities, and engaged in peer-learning. Seventh, digital storytelling as a medium of communication was adopted. And finally, the instructor's role was that of a facilitator and coach rather than a *'sage-on-the-stage'*.

Creating a successful learner-centered experience requires a fine balance of structure while providing the freedom to navigate ambiguities in the learning process. Students were enthusiastic of the Ergo-Studio since it built on their design training, challenged them to apply knowledge in a real-world context, and offered a sense of ownership. If used effectively, experiential learning can empower students and instructors to engage with the course intellectually, creatively, physically, socially, and emotionally to enhance the teaching and learning experience.

Keywords: Experiential learning, Workspace ergonomics, Learner-centered course, Project-based learning, Peer-learning, Flipped classroom.

An Empirical Study on Cognitive Impartment of Knowledge in Children Through Augmented Reality

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Abstract: Utilization and implementation of modern technology have become a necessity in various domains of society for proper and updated growth in that particular sector. Children are most influenced by this wake of modern technology in their daily life. This paper aims towards investigating the amount of interest generated among children through their present academic course curriculum and proposal of a design training module for children. The module would essentially deal with the comprehensive representation of educational information through AR. The advantageous aspects and challenges of using AR in the education sector, were tallied by conducting a survey among children and their parents using module prototype and questionnaire. An in-depth analysis of the subject matter was done about proper utilization and implementation of the proposed aspect. Augmented Reality (AR) being an advanced technology for a big chunk of the masses, especially children, could prove to be an interesting element to Indian education scenario. The study ventures through the possible future scope of the module into generating cognitive impartment of knowledge while also introducing fun and engagement into study materials through Augmented Reality.

Keywords: Augmented Reality, Education, Design Module, Interaction.

Efficacy of Sex Differences on the Perceptual Experience of Virtual Building Images

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Abstract: The current study focuses on the perceptual experiences of Indian males and females on structurally significant buildings. Environmental perception is based on the contextual significance or imposed meaning of environmental elements and built structures. Cognitive psychologists have extensively researched how individuals respond to various social circumstances. However, scarce studies examine the socio-psychological factors which reflect male & female perception of the virtual models. In total, 99 healthy individuals were volunteered, and each was assigned images of 17 virtual buildings along with five key questions to respond on a 10-point Likert scale (a total of 85 presentations). Participants answered five questions about identifiability, comfort, male-centric, environment space, and place sociability of the structurally significant buildings. The virtual building perception significantly varies between male and female participants. Males rated significantly higher on the level of comfort and level of male-centric compared to females. The results indicate sex biasedness on the perceptual experience of virtual buildings. Findings also suggest the efficacy of sex differences in social, cultural, and gender preferences in selecting virtual models.

Keywords: Perception, Building-Models, Virtual-Reality, Sex-Difference, Male-Centric, Environment

Science Mapping to Visualize The Factors Influencing Workers' Fall from Height in Construction Projects

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Abstract: Science mapping is an essential application of visualization technology widely used in safety, psychology, and environmental science. This study used the VOSviewer tool to visualize factors influencing workers' falls in the construction industry. Based on Scopus Index articles published between 2000 and 2019, 343 documents on FFH studies were retrieved, and a total of 96 met the relevance and quality criteria. Using keyword co-occurrence analysis in the VOSviewer tool, the keywords were clustered into different subjects and used to describe the causal factors in the fall from height (FFH) domain. Workers' attitudes, workplace conditions, dangerous tasks, organizational characteristics, agents, and workplace environment were associated with falls. This study's findings will help research into the causes of falls in construction, the development of policy, engineering controls, and intervention design to minimize the risk of falls in the future.

Keywords: FFH, Construction, Safety, Science Mapping, Factors, VOSviewer.

Assessment of Respiratory Health of Wood and Stone Occupation Workers: A Review

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Abstract. Respiratory health of wood and stone occupation workers has become a prime concern due to ceaseless exposure to the accumulation of dust results in respiratory tract infection. Review studies on the assessment of respiratory health of wood and stone occupation workers are up until now lacking, accordingly there is an urge to review such environmental health problems further. The present study emphasizes on the assessment of respiratory symptoms of wood and stone occupation workers along with recognition of associated respiratory disorders. The literature is adopted from Web of Science and Scopus database and by analyzing the abstracts and findings 38 articles have been preferred for this review. The major aim of this review is to present the key factors which are responsible for the assessment and declination of respiratory health of wood and stone occupation workers on a single platform, consequently providing the directions for upcoming research.

Keywords: Respiratory Health, Respiratory Assessment, Respiratory Symptoms, Woodworker, Stoneworker.

Virtual Reality Reducing Cognitive Load in Travel Planning

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Abstract: Planning and executing a vacation can be an exhausting process. Several factors influence vacation planning. The most important factors are the destination & the accommodation. People face difficulties in deciding the destination that allows them to experience the location with a suitable accommodation. Social media plays a crucial role in promoting different destinations and providing associated travel information influencing travelers to finalize a location. Deciding the location on the bases of online content often causes disappointment. Virtual reality has been proven earlier to enhance the experience and streamline the way information is presented to the viewer. This research aims at exploring the possibility of including further technological advancements to reduce the extraneous cognitive load taken by a tourist while planning a vacation. The objective of the research is to understand the multi-stage process in tour planning in order to aid stress free and quicker travel planning. The data was collected by survey and interviews to note the travel routine and understand the process of decision making and the reasons leading to informational overload while planning a trip. The data collected was analyzed both qualitatively and quantitatively. Enhancing the tourist 's experience by incorporating technology in the tourism industry reduce the bombardment of irrelevant visuals and information and simplify the decision making process. Incorporating virtual reality in the planning stage of a vacation will increase the confidence of the tourist in their travel decisions and encourage them to explore a wider variety of options in lesser time before booking.

Keywords: Virtual Reality; Travel planning; Cognitive load reduction; Travel Experience; Cognitive Ergonomics

Bucky- The Study of an Ergonomic Design Intervention for a Bucket Carrying Task

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Abstract: Carrying a bucket of water is one of the most common yet strenuous tasks performed on a daily basis. This manual handling exposes the user to awkward postures; repetitive movements in turn causing Musculoskeletal disorders (MSD); repetitive strain injuries & cumulative trauma disorders. This manual task also hinders the range of motion, reducing the efficiency, increasing the time and energy of the user. This research deals with the evaluation of the task through ergonomic assessments used to gauge posture and provide solutions to the problems in the form of a newly designed product. An experiment was created to assess manual handling through ergonomic assessments where data was collected through Observation methods, Videos, Photographs and Questionnaires to assess the task. Ergonomics Assessments-RULA (Rapid Upper Limb Assessment); REBA (Rapid Entire Body Assessment); OMPQ (Orebro Musculoskeletal Pain) questionnaires were conducted to assess the risk factors. The experiment showed that such a simple task was demanding as the scores from RULA and REBA majorly belonged to the 'very high risk' category. Utilizing the concepts of the lever system and hydraulics, the purpose of this study was to design an ergonomic 4-wheel trolley, equipped with a bracket and adjustable handle to overcome obstacles, improving efficiency and occupational safety, reducing the risk of slipping and/or toppling and single-handedly safe transport of the bucket. The solution is to design a product to ease the work and improve the safety and ease of the task by ensuring a better posture.

Keywords: Physical Ergonomics; Musculoskeletal Disorders; Repetitive Strain Injuries; Efficiency; Safety

Why does an Indian Construction Worker Fail to Wear Personal Protective Equipment (PPE) at Workplace?

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Abstract: Personal protective equipment (PPE) is an essential control measure used in developing countries to protect workers from hazards and risks in the construction industry. The purpose of PPE is to reduce workers' exposure to the environment. From the literature, it was noted that a worker not wearing the provided PPE or the absence of PPE at the workplace leads to the cause of accidents in construction every year. The purpose of this study is to examine why workers fail to wear PPE on Indian construction sites. A structured questionnaire-based study was carried out among workers of the construction industry to collect data. The factors that influence the workers not to wear PPE in the workplace were analyzed and represented graphically under the following three sections (i) design-related aspects; (ii) management-related factors; and (iii) human-related factors based on the workers' job and their age group. This study revealed that most workers understand the importance of PPE and want them to protect themselves from accidents/injuries. However, there is a need to address the issue concerning PPE on construction sites. This study's outcome can be used for effective use of PPE among all workers at the Indian construction site and enhance health and safety. Further involvement in promoting the use of PPE should be focused on the availability of PPE, job duration, and presence of shift work.
Keywords: Construction Safety, PPE, Construction industry, Workers Safety, Behaviour, India.

To Explore an Innovative Process to offer Personalized Learning by Providing Localized Accessibility for both Teachers and Students with the Help of a Mobile Application

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Abstract: In India, there exists a system of private or personalized learning at home in parallel to the regular academic classes offered at schools to overcome inadequacies in the learning process. The system is commonly termed tuition in India, which many school-going kids used to follow. Moreover, students who desire to excel in academics invariably also follow personalized coaching for their studies. Though various online coaching firms like Byju's, Vedantu, etc. are available nowadays, no such online platform is used to offer tutors who would offer service for both offline and online mode. Hence, an alternative tutoring platform may be desired that can address the limitations of personalized coaching by offering both offline and online modes with quality services.

This study was particularly carried out to conceptualize such an online platform by creating an application for digital devices which may address the necessity of personalized coaching with exclusive offerings. The app concept has been designed to help students and their parents to search for tutors of different subjects and getting in touch with them physically and virtually both for personalized coaching. The app further explores connecting people of quality teaching capability from varied fields to a wide range of students from different places for knowledge exchange and learning. The primary focus has been put on content interactivity and smooth flow of information and navigation style for the users to make the application efficient and effective.

Keywords: Personalized learning, Interactive learning app, Home Tuition, Personal Tutor, Home schooling, personalized coaching app.

Digitized Visual Fatigue Detection for Humanizing Digital Work Environments

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Abstract: The recent outbreak of the COVID-19 pandemic has led to an increase in digital screen time. This extended screen time has led to an increase in visual fatigue levels in the users of digital information displays. Users of these displays tend to ignore the visual fatigue in the initial stages thus causing it to accumulate over time. A visual fatigue level beyond the circadian limit can lead to serious problems. In order to avoid the build-up of visual fatigue to such an extent, it is imperative that the visual fatigue level of the users is checked and managed at regular intervals.
This research work was aimed at developing an easy to administer digital test for checking the visual fatigue level of the digital information display users. The decline in visual accommodation with increase in visual fatigue has been used as the basis for developing this test. The digital test has been calibrated against the readings from a standard visual fatigue test.

Keywords: Visual Fatigue, Visual Accommodation, Digitized Visual Fatigue Test, Digital Work Environments.

Understanding The Usability of School Stationery and The Scope for Innovation

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Abstract: Geometrical construction refers to a precise way of drawing and measuring lines, grids, curves, and angles using appropriate tools. This paper discusses a new design of a ruler, targeting school students, that equips the users with a single tool that can perform most of the essential geometrical functions at a non-commercial accuracy. Students are introduced to geometric tools in 5th grade. Although the most basic geometry box available in the market today consists of a 15cm ruler, a compass, a divider, 2 set squares, and a protractor, some of these tools are rarely used. Having several tools also increases the cognitive load on the users and hampers portability. Moreover, carrying the whole set isn't always feasible, and thus, the users tend to lose tools at crucial times. Pre-existing multifunctional rulers, at times, fail to serve their purpose as they can be devious to work with and overcomplicate simple functions. These insights are backed by our user research, collecting data from a sample size of over 350 users ranging from 10 to 65 years of age, spread across multiple disciplines. These problems can be readily solved with an all-in-one solution, that fixes these issues. The newly designed instrument, which is in its user testing phase with a sample size of 15, an L-shaped ruler, intended to measure distances and draw straight lines like a conventional ruler and construct and measure different angles, perpendiculars, and parallel lines, thus effectively eliminating the need for set squares and protractors and making it highly portable.

Keywords: Scale, Guides, Protractor, Multipurpose, Geometric instrument, Try square

Oro White Toothbrush | Design and Conceptualizing Dental Caries Detection Method

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Abstract: We are living in a world today where stopping or halting can cause tremendous loss to our society. We have learned this lesson in the pandemic of COVID-19 the hard way. But a pandemic is not only the reason that can cause a halt. Toothache pain is described as intense, throbbing, miserable, or unbearable as it can affect a person's ability to perform normal activities such as job, social activities, housework, talking, sleeping, and eating, all of these factors can result in mental health problems and halting their everyday life. In this particular design intervention, a device and a mobile application have been conceptualized as a solution, which will help common people to detect potential dental caries and will be able to take precautions. The device is a toothbrush specially designed and conceptualised that can detect tooth enamel decay. This data will be analysed in the mobile application to inform the user about their dental health.

Keywords: Product Design, Ergonomics, Medical Product, Dental Care

Ergonomic Risk Factors Among Eye Care Specialists- A Study of Community Outreach Health Camps of Assam

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Abstract: Healthcare professionals are likely to face debilitating musculoskeletal disorders (MSDs) when screening their patients for any health-related abnormalities. This holds for most of the community outreach eye camps of rural Assam. Field studies at 17 health camps provided insights into the present scenario of eye care services and potential risk factors associated with specific routine procedures. A rapid upper limb assessment (RULA) worksheet, along with a modified Nordic Musculoskeletal Questionnaire (NMQ), was used for the study. Perceived discomfort level and occurrence after a health camp were measured using Borg's and Likert scales, respectively. Stick diagrams of postures adopted by the specialists during eye screening were prepared for RULA analysis. 170 observations corresponding to each screening procedure at the eye camps was used in the analysis. Objective refraction followed by indirect ophthalmoscopy, subjective refraction, and slit-lamp examination reported mean RULA scores of 6.87, 6, 5.77, and 5.09, respectively. The perceived discomfort level of the eye care experts ranged from 2 to 6.47, with knees being the least rated region and lower back the most. Job-related risk factors like performing the same task repeatedly, working for an extended period, awkward postures, insufficient breaks were reported by the respondents as contributors to musculoskeletal disorders while performing the routine procedures at the campsites. The study's findings contribute to understanding the physical discomforts that the eye care specialists face in the community outreach health camps. A high rate of musculoskeletal abnormalities was observed during the analysis that accounts for immediate ergonomic intervention.

Keywords: Health Camps, Eyecare, Ergonomics, Musculoskeletal Disorder, RULA, NMQ.

Ergonomics Analysis of Working Posture in Household Cleaning Using Technomatix Modeling

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Abstract: Household and commercial cleaning is a vital virtue of life. It is advantageous in many ways, and the prime one being it helps to keep an individual healthy. Cleaners working in this area are faced with serious musculoskeletal disorders (MSD), due to prolonged hours in the same posture, repetition in the task, contact stress due to tools or postures. The objective of this study was to explore upper limb musculoskeletal disorders and postural risk among cleaners. In this study, awkward working posture takes on by cleaners in houses has been observed and analyses using ovako working posture analysis system. A housework system model is developed and simulated in computer-aided ergonomics assessment tool Technomatix with implicit cleaners with their specific systematic measurement of the physical properties of the human body. Trunk postural load was found more significantly and also motion angle of the wrist was found repetitive

Keywords: musculoskeletal disorder, technomatix, ovako working posture analysis, ergonomics, cleaners

An Intensive Analysis of the Problems & Strategies implemented during the COVID - 19 outbreak: Mitigate, Recover, Rehabilitation and build Resilient communities

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Abstract: This paper highlights the problems faced during the pandemic, as this pandemic caused adverse ramifications and washed out many vulnerable communities. Healthcare systems and providers raised their capabilities and capacities promptly to battle challenges that were unprecedented. Yet, a lack of prompt response has led to huge global losses in all the major sectors. Hence, after analysing such vulnerabilities, how can communities resist and withstand such vulnerabilities to survive. This paper recommends the elements of resilient communities and aims to contribute six futuristic strategies from the identified pitfalls and the potential scope for mitigating the impact and accelerating the road for recovery and resilience. Acknowledging the social change, this paper also presents a product solution to protect oneself from disorders caused by the SARS Covid - 19 virus. This ergonomically designed product is versatile, and its unique features make it user-friendly which will protect, revive, and recover the immunity for users of all age groups and especially the ones who are always on the go. This will imbibe a positive behavioural change for the well-being of the users paving the way for quality life.

Keywords: Covid 19, community resilience, pandemic, product solution, quality life.

Rotating Cylindrical PIN VR Display - An Ergonomic Approach for VR Scripts

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Abstract: A Rotating Cylindrical Display is recommended as an ergonomic approach for the communication of scripts in Parallel Interactive Narratives in Virtual Reality (PIN VR). VR studies propose grammars to orient a navigator's gaze towards intended areas; however, it is argued that it is this limitation of the navigator's ability to choose their own viewing direction, which restricts the full potential of the medium. PIN VR experiences address this limitation by allowing the navigator to teleport from one narrative location to another; while the remaining narrative locations run in parallel sequences, irrespective of the navigator's presence. A study on scriptwriting for VR reveals that there is no standard approach for VR script design. This leads to the possibility to explore scriptwriting for PIN VR experiences. Through a Screen Production Enquiry, a PIN VR script has been attempted in a Traditional and Spherical Format. It is observed that these formats limit the representation of parallel narrative timelines. An ergonomic solution is found in a combination of a Tabular Format and a Rotating Cylindrical PIN VR Display. The display includes parallel scripts mounted around the surface of a cylinder. The display adopts relevant ergonomic and functional details from a rotating literature rack and a digital kiosk display. The Rotating Cylindrical PIN VR Display has been tested with VR production crew members for its ergonomic and visual communication effectiveness.

Keywords: Rotating Cylindrical PIN VR Display, Scriptwriting, Virtual Reality, Parallel Narratives, Visual Communication Ergonomics, Screen Production Enquiry.

Braking: The Most Strenuous Task of Locomotive Driving

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Abstract: Pilots of the Indian Railways are susceptible to high risk of morbidity and low retirement age. This field study suggests these conditions arise from poor cab room configuration design and result in habituation to unsafe postures, which yield psycho-physiological stress on them. The paper evaluates the physical actions in applying the brake, and identifies the WMSD (Work-related musculoskeletal disorders) risks and calls for a modified procedure to ensure safety and pleasure at work. The methodology investigates with 29 male electric-loco pilots of 41.34 $\pm$ 5.19 years. A pilot performs several primary functions, including brake application. Rapid Upper Limb Assessment (RULA) was used to evaluate all those driving postures, aiming to identify the probability of musculoskeletal disorders amongst loco pilots. RULA score in breaking actions revealed that about three-quarter of the population require intervention of 'action level-2', and the remaining 'action level-3'. The braking posture worsens gradually over time arising from the magnitude of force required leading to abnormal deviations of postures in legs, wrists, and upper limbs. Few modifications in the braking arrangement including the controls and their configurations and relative action-postures are proposed which *may* subsequently reduce the RULA scores and correction demands to offer more crew friendly braking actions. Considering the momentum of the loaded goods train of about 58 wagons plus the electric-loco is not a pleasant task till date.

Keywords: Braking actions, Electric goods-train, Loco-pilots, RULA, Ergonomic assessment.

Impact of Writing Tools in the Evolution of Telugu Script

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Abstract: The paper brings to focus, the role of the writing tools and writing medium on the evolution of the Telugu script from Brahmi script. It also correlates with the time period of the script transformation. The information on the Telugu script from the published works of prominent historians and linguists was studied. Then the data collected from various sources such as manuscripts, inscriptions, and library archives were analyzed and presented. The evolution of the Telugu script reaches a pinnacle by the end of the 20th century AD, thanks to the standardization process that is necessary for a print-oriented mass modern society. However, due to the creative demands of the advertising and book publishing industry, the artistic dimension of the script found expression. The paper lays special emphasis on the impact of ergonomics of the Ghantam (metallic stylus) and the tool interaction on the Tadipatra (processed palm-leaf writing surface) and its influence on the rectilinear and curvilinear letterforms.

Keywords: Telugu Script, Writing tools, Human factors, Letterform evolution.

Exploring Pedagogical Influence and Cognitive Learning on Children by Implementing Innovative Intructional Design Methodology for Learning English Alphabet Writing from Drawing

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Abstract: The foundational process of learning that starts in our life at the very early stage help create a lifelong influence on us throughout our entire life. Therefore pedagogical influence on children in the kindergarten level is the most crucial stage as they start learning things very quickly at their early age. In the foundational stages, children learn how to read and write as per the instructors' directions, where the teaching approach of the instructor plays an important role in guiding and making children comprehend the information. Hence, instructions designed specifically on a particular subject for the children of the kindergarten stage carry solemn responsibility to nurture preliminary knowledge in them. This study carried out an innovative experiment where the method describes the technique of learning the English alphabet system by drawing a figure from letters and vice versa with easy-to-follow steps which have made the learning and teaching process more fluent. The objective of the experiment was to make children learn the English alphabet system by following a methodology that shows writing of a letter by resembling it with an object, and how to draw that object from that particular letter in very easy-to-follow steps. The study has aimed to nurture the creative and cognitive side of a child by teaching them observation and drawing while building a strong foundation of the English language. Further, the study has also aimed to deliver a complete book with step-by-step instructions which could be useful for the instructors teaching in kindergarten schools.

Keywords: Pedagogical activity, Instructional design for children, English learning methodology, Cognitive English learning for children

Sound Design for Cinematic Virtual Reality: A State-of-the-Art Review

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Abstract: In the last decade, the rapid development of low-cost 360-degree cameras, Head Mounted Display, smartphones, and open-source software's have created new possibilities of immersive storytelling in virtual reality, popularly known as cinematic virtual reality or virtual reality films. Even in 360-degree videos, the visual experience remains limited to field of view of head mounted displays. Hence, the spatial audio is considered essential to create 'Presence' and 'Immersion'. The viewer is part of the virtual environment with the freedom to interact, navigate, and choose the viewing direction. This presents challenge of sound recording, designing and playback. The recent development in spatial audio recording, sound synthesis and rendering has addressed some of these challenges. The current study presents the state-of-the-art of sound design in cinematic virtual reality through literature review and textual analysis of the relevant publication in the field since 2015. The objective is to identify further scope of studies. This review could be useful for filmmakers, sound designers, and scholars working in the field of cinematic virtual reality.

Keywords: Virtual reality, Immersive storytelling, 360-degree, spatial audio, Film, Sound design.

Study of the Effect of Worker Characteristics on Maximum Acceptable Weight of Lift

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Abstract: Manual material handling (MMH) and lifting activities have been identified as risk factors for low back pain (LBP). Statistical findings suggest that about 50% of all back pains are related to manual lifting. Of the many tools available for analyzing and designing lifting tasks, the revised NIOSH lifting equation (RNLE) is perhaps the most widely used. An inherent limitation of the equation is that it addresses task demands only. However, load lifting task is dependent not just on the characteristics of lift but on worker characteristics like age, gender, weight, anthropometry and ethnicity. Thus, the present study investigates the role of worker characteristics like age, gender, BMI and anthropometric variables in a manual lifting task. A psychophysical methodology was adopted to arrive at the maximum acceptable weight limits (MAWLs). 44 industrial workers (22 males and 22 females) participated in the study. ANCOVA for gender using age, height, acromial height and BMI as covariates showed that BMI, gender and age had statistically significant effect on MAWL while the effect of height and acromial height was statistically non-significant. Further, it was observed that the recommended weight limit (RWL) as obtained by the RNLE was 17.2 kg. However, using the psychophysical criteria of 75th percentile women (as per the RNLE guideline), in the present study a MAWL of 19.3 kg was found.

Keywords: Manual material handling, Manual lifting, Revised NIOSH lifting equation

Traditional Cultivation Practices of Water Chestnut in Northeast India (Assam): A Field Survey

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Abstract: Water chestnut is grown as a food crop in most of the states in India. Despite having high medicinal value and economic importance, Indian farmers still follow traditional cultivation practices for water chestnuts. Being informal in nature and not being considered mainstream economic activities, cultivation practices of aquatic food crops like water chestnut, have not received due importance. Thereby, the modernization of the cultivation practices has been ignored. As the cultivation practice is not well documented and not readily available, it could not draw the agricultural researchers' attention for their intervention. Hence, the current research aimed to gather information on the traditional cultivation process of water chestnut along with documenting the challenges in the entire process. To achieve the goal, a detailed survey was conducted from 3 sites that were purposely-selected from the north-eastern districts of Assam, India. It was noticed that the water chestnut cultivation across the sites follows the common five phases: seedling preparation, cleaning of water bodies, transplanting, inter-culture, and harvesting. Cleaning of water bodies and harvesting were found to be more difficult and time-consuming activities. As the farmers need to remain inside the adverse aquatic environment for 5-6 hours/ day, they suffer from various health-related issues, including body-pain, itching, and swelling in the lower body. The current research findings would facilitate exploring the future research avenues towards increasing productivity, thereby enhancing livelihood and motivating the researchers to come up with intervention strategies for the reduction of the drudgery of the farmers.

Keywords: agriculture; aquatic crop; harvesting; drudgery, farmers

Development of an Effective Scale for Measuring Empathy of Indian Nurses

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Abstract: Empathy is an emotion that allows a person to enter another's shoes and understand where they come from. It is also an important emotion that empowers healthcare providers to care for patients and each other and is essential to engage patients as partners in care. It is an emotion much needed in nurses as they are in regular touch with patients and their families. However not much study has been done on the empathetic behavior of Indian Nurses. The Jefferson Scale of Empathy (JSE) is the best-known tool globally for measuring empathy in of healthcare professionals. However, there are no existing tools that capture the Indian context for empathy– these factors include the bearing that the socio-economic strata, family and educational background and shortage of resources in the Indian Nursing scenario and their influence on the motivation and empathetic behavior of nurses. This paper addresses a pilot study that was conducted on 18 Indian nurses to arrive at a scale to measure empathy in the Indian Nursing scenario. Various keywords related to empathy were identified from interviews with experts (Human Factors, Healthcare and Behavioral Design). The new empathy scale covers cognitive, affective, and motivational aspects of empathy, and the responses for each item was consistently rated by Indian nurses (Cronbach's alpha > 0.70). Therefore, the new empathy scale is reliable.

Keywords: Affective, Behavioral, Cognitive, Communication Skills, Empathy, Indian Nurses

The Impact of Service Quality on Customer Loyalty of Indian E-commerce Industry: The Mediating Role of Customer Satisfaction

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Abstract: India has the fastest-growing e-commerce market, which has resulted in widespread acceptance and use. The first impression of a customer is formed by the quality of the shopping website. This paper investigates the service quality of four major e-commerce websites in India's domestic market and ex-plores the links between their service quality and customer satisfaction. The data was collected from 250 customers using a structured questionnaire, and the results were analyzed using PLS-SEM and SPSS 20 statistical measures. Satisfactory service was found to result in higher customer loyalty among online cus-tomers. In comparison to amazon, customers who bought from flipkart, myntra and paytm mall were more likely to switch to an alternate website, indicating lower levels of brand loyalty. Empathy had a positive and significant effect on customer's overall satisfaction and in turn strengthened customer loyalty. Cus-tomers today differentiate internet-based service companies based on tangibility, responsiveness, and reli-ability of the companies rather than perceived credibility and security of the services offered, according to the findings. Based on the results it can be concluded that this research offers empirical evidence of the relationship of service quality, customer satisfaction and customer loyalty. Furthermore, the study sug-gests that to attain maximum customer loyalty, high-quality service should be provided. It was also sug-gested that existing regulatory agencies be revived to assure the proper implementation of good service quality delivery among India's e-commerce websites.

Keywords: E-commerce, service marketing, service quality, virtual enterprises, consumer preference, and internet marketing.

Proposed Improvisation in Gun Shooting Skills, Especially on Moving Targets to Enhance Efficacy of Shooting Training Vis-à-Vis Modern Day's Security Preparedness

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Abstract: Gun shooting skills are broadly classified into two categories. Shooting at static targets and shooting at moving targets. It is a well-known fact that the degree of skill required to shoot accurately at moving targets is higher than that required for shooting at static targets. Gun shooting skills are imparted through training to all personnel engaged in security related duties, i.e. defence personnel, paramilitary personnel and police forces. Study review on the existing pattern of shooting training in vogue clearly brings out two distinct things. First, the pattern of training is largely common amongst various organisations. Second, shooting training to most personnel within the organizations is largely focused on static target firing only, excepting army. In the past few years, in the backdrop of terrorist attacks on organisations / personnel other than army, it can be deduced that all security related organisations have equal/ growing vulnerability. Hence, in this context of measuring 'preparedness' of security personnel in terms of weapon firing skills required, especially for organisations other than army, a review of efficacy of existing training pattern reveals that there is an impending need to modify / strengthen the existing training pattern, so as to make it suitable/ comprehensive to meet modern day's security preparedness/ requirements. This paper attempts to analyze/suggest requisite modifications in existing training pattern, to identify the requisite skill set that needs to be additionally imparted in training to the soldiers/ uniformed personnel, so as to make them highly competent to face modern day's security challenges.

Keywords: Gun Shooting Skills, Modern Day Security Challenges, Training Efficacy

Empathy, Vulnerability and Learning Theories in Higher Education

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Abstract: A number of students arrive at the University after much struggle and anxiety during their final years at school. For some, circumstances and opportunities have provided for tumultuous experiences causing the mental disbalance among such students. This paper aims to identify the instructional environments that are vulnerably not empathetic for students in higher education and to strategise a theoretical framework to strengthen the empathetic values in the learning environment for helping learners in higher education. Referencing the various theories of pedagogy and Instructional Design, the ideal set of values for learning will be established. Taking into account the aspirational and emotional quotient of the present day learner, various psychological support techniques will be identified and tested for their viability in the higher education learning environment. Analyzing the impact of various pedagogical styles, emotional quotient and aspirations of the learner in higher education and envisaging the challenges of the modern day teacher develop a strategy to prepare the theoretical framework for an empathetic learning environment. This paper identifies the structure for a learning environment in higher education, based on empathy and respect, leading to an ever resonating and congenial teacher – learner relationship.

Keywords: Emotional, Empathy, Gen Z, Higher Education, Instructional Design, Vulnerable Learners

Role of Design Control Interventions in Ameliorating Hot Stressful Thermal Work Ambience: A Review

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Abstract: Hot-stressful work conditions may cause greater risk of heat-related morbidities and safety threats to users' employed; especially in developing countries having low and medium incomes. Prolonged heat stress exposure could significantly affect users' physiological response in terms of heat strain; resulting in subsequent performance-loss and further attributes to economic burden. Concerned negative impacts necessitates remedial control measures based on minimizing the associated exposure risk levels. Present study aims at depicting the efficacious role of control interventions in improving occupational heat stress under hot work conditions with environmental ergonomics perspective. Reported literature work includes studies related to implementation of engineering control interventions, role of sensor based intelligence and simulation based applications; emphasizing on ameliorating the hot stressful work-conditions. Research findings revealed that engineering based interventions could lower the heat-stress exposure levels upto desired permissible limits under the existing thermal work-conditions; however simulation studies may be helpful in suggesting appropriate design interventions based on improving thermal work ambience. Although, recent technological advancements in sensor intelligence could enable heat stress data monitoring and analysis at substantially lower cost; with additional benefits like early warning systems, real-time physiological monitoring (indicating heat strain) and automation control based on threshold limit values. With several associated benefits, it may be concluded that these control interventions could play a dominant role in significantly improving the health and safety of users' employed under hot stressful work environments.

Keywords: Heat stress, negative impacts, control interventions, safety.

Status of Political Cartoons in Indian Society: A Human Commination Perspective

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Abstract: India and Indian society and people change here lots during last 10-15 years. As the influence of digitization People changes lot, there habits also change, print media is decreasing value day by day. Unknowingly we are surrounded by technology. This study aims to unfold the status of political cartoon based on available evidences from online and printed resources such as, articles, review articles, reports, books, news etc. This research work has successfully covered the characteristics of political cartoons in print and electronic media. Where Importance of political cartoon has changed cartoonist developed technical skills. Authors of this paper analyses the human factors issues related to political cartoons to assist scholars to discover novel concepts in evolving fields of Indian political cartoon.

Keywords: Cartoon, Political Cartoon, Common Man, Indian News, Social Impact

Gender Role Portrayal in Indian Advertisement: A Review

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Abstract: Gender role portrayal in a communication design area of advertisements plays a vital role in shaping our behaviour to emulate or react against. In India, men and women are witnessing gender discrimination for generations, affecting the lives of both genders. This review paper focuses on past studies of gender role portrayal in Indian advertisement to comprehend the contemporary situation of gender representation. Around thirty articles have been analyzed between the years 2000 and 2020. The article and conference papers that are published in the English language have been considered for the undertaken study. Based upon the study, the magazine print advertisement shows that gender stereotype still exists in Indian advertisements. The findings of the study reveal that stereotype portrayal of gender is used in different product categories. Moreover, sexism and degrading portrayal of women are used to sell product in Indian advertisement. Some researchers also observed a slight improvement in women representation in Indian advertisements. Based upon this study, a few gap areas are identified in the study of gender role portrayal in Indian advertisements. The study also provides a platform to fill those lacunas for future researchers.

Keywords: Gender-role portrayal, ,stereotypes, Indian advertisements, human factor,cognative ergonomics.

Visual Analysis of Narratives in Naamghars of Assam

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Abstract: Visual narratives are the most important aspects and culture threads which bind together the people and their belief in Naamghars and Satras of Assam, It has been brought into existence in Assam by the Vaisnavite Saint Srimanta Shankardeva between 12th and 15th century AD. Naamghars are the vernacular structures where communities come together to reside the name of God as well as its the central meeting point for the communities to preserve the culture of Assam [7]. There are major design elements which narrates and depicts the stories on the walls, pillars, jali's and other corners of the Naamghars with intricate traditional craftsmanship rooted with semantic and metaphorical meaning. In this study the researcher has found that the design elements were planned using elements related to dashavatar, specifically Vishnu, which is associated with flowers like lotus. Creators of Naamghar have incorporated 'nirmali' flowers and lotus to build the connection with devotees in the space of Satra and Naamghar. Extensive field survey has been done with 263 respondents to derive on the list of narratives and design elements which retains the identity of Naamghars. Data repository has been created with the help of primary and secondary research and its segregation has been done in rural, semi-urban and ur-ban settings of Naamghars to analyze the major narratives which constructively retains the designs of old age traditions in Naamghars of Assam.

Keywords: Naamghar, Social-Cultural Institution, South-East Asian cities, Design Elements, Multidisciplinary Culture, Vernacular Architecture

Modifying the Revised NIOSH Lifting Equation in the Presence of Noise

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Abstract: An Experimental research was conducted to modify the revised NIOSH lifting equation (RNLE) by determining the effect of various noise levels on recommended weight limit (RWL) during symmetric and asymmetric lifting. Seven male college students were recruited as participants. Each participant performed 16 different lifting tasks. Subjects were required to lift a box from the floor to a 76cm high pallet for a period of 15 minutes. A psychophysical methodology was used to establish the acceptable lifting frequency for different combinations of load, asymmetry and noise levels. Oxygen consumption was also measured both at rest and immediately after the experiment. The observations gathered were analyzed using ANOVA, which showed a significant effect of all three variables viz load, asymmetry and noise on lifting frequency as well as oxygen consumption. RWLs were calculated using RNLE and it was observed that they decreased with increase in load, asymmetry and noise. On the basis of the experimental results a RNLE multiplier was suggested for load lifting in the presence of noise.

Keywords: Noise, Load Lifting, Revised NIOSH Lifting Equation, Recommended Weight Limit

Quantitative and Qualitative Study on Lifestyle of Polycystic Ovarian Syndrome or Disease (PCOS/PCOD) Patients

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Abstract: Polycystic Ovarian Syndrome (PCOS) is a common condition in women nowadays. The previous studies show its direct correlation with infertility, type 2 diabetes, heart disease, and other major illnesses. This study aims to give a detailed understanding of PCOS quantitatively and qualitatively. The study began with interacting with three reputed gynaecologists, to understand PCOS and other related complications. Later, a survey on PCOS of 43 random women was undertaken to quantitatively analyze the data. Further, four participants expressed interest in a detailed qualitative interview. The questionnaire for a qualitative study focused on the parameters like time since PCOS was diagnosed, symptoms, relation with diabetes, stress, medicine, diet, exercise, the reason for neglecting doctor's advice, etc. All the insights were mapped out on a white canvas to find out the patterns, their pain points, as well as gain points. Out of 43 patients, it was diagnosed that 18 females were suffering from PCOS. Out of 18, more than half of the participants followed the advice on diet control but they followed it blindly. Those four interviewed participants stated that they had diabetes in their family background and due to PCOS, they could be more prone to be diagnosed with type 2 diabetes. The study opens up many opportunities for the design intervention on a domain that is critical but often neglected due to unawareness. This research on PCOS patients' mindset and behaviour towards managing PCOS may become an important resource while ideating on the solution to the identified problems.

Keywords: Polycystic Ovarian Syndrome or Disease, Qualitative Research, Quantitative Research, Infertility, Lifestyle, Diet and Exercise

Sustaining Heritage Culture through Visual Narrative Design

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Abstract: In the Northeast India, certain heritage places need reanalysis for the classification of being an important historical place. Even though, the north eastern states has been bestowed with natural scenic landscape and rich cultures, little has been known to the outside world about the psychological and historical events of its local heroes who sacrificed their lives for the little paradise. The paper aims to explore one of the cultural heritage sites and focus on conveying the information through a visual narrative art form and it might support if the story of the legendary warriors is communicated through visual representation. The paper investigates through field survey and visual design implementation to sustain the historical facts along with the preservation of the heritage site.

Keywords: Khongjom War, Kongjom Parba, Anglo-Manipur, Design Heritage, Cognitive thinking, Indigenous art.

A Sustainable Approach for the Urban Sprawl of Kolkata (Circa 1690-2020)

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Abstract: Kolkata, hitherto known as Calcutta, till 2001, is the capital of West Bengal, India. Sutanuti, Kalikata, and Gobindapur were three villages that amalgamated today's town, which has a more than 300-year history and acted as the capital of British East India through 1911. Although one of India's oldest Heritage cities is developing in becoming the Smart City, the city has never designated planning policies. The Kolkata Municipal Corporation Authority (KMDA) was established in 1962, whereas the city's coalescence occurred in 1690, leading to an extended period of unplanned city growth. Asymmetrical urban sprawl evolved due to several factors, creating multiple challenges for the city and its inhabitants. As a result, an immediate requirement for examining the urbanization over time till the current scenario to formulate subsequent development plans would be sustainable. The implementation of remote sensing data and GIS helps to analyze data to provide sustainable design approaches. This paper addresses problems that contribute to urban sprawl while promoting sustainable design to mitigate the future's negative consequences. Urbanization and population growth, whereas the leading cause of urban sprawl, sustainable techniques provided would balance the heritage of past and future.

Keywords: Heritage; Urban growth; Sustainable Design; Planning policies; Smart City.

Working Posture Evaluation of Bus Drivers - using CMDQ and RULA Technique

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Abstract: Work-related musculoskeletal disorders (WMSDs) are the major issues in various fields of work. But the same is more prevalent in the case of heavy vehicle driving. It has been noticed that multiple studies on WMSDs had already been carried out on heavy vehicle drivers abroad. However, those ergonomic interventions failed to provide any directives to make the driving a safe and pleasuring task. In this scenario, the intensity of musculoskeletal problems associated with bus driving and other critical issues influencing automobile driving have been evaluated to suggest suitable remedial measures. The study focuses on the psycho-physiological aspects of a bus driving through the ergonomic intervention of driving posture and driving seat. By which it assesses the degree of musculoskeletal symptoms on various body segments and their frequency. The study includes follow-up studies on long-term muscular disability among bus drivers (n = 32) and questionnaire studies on the prevalence of back pain. Their driving postures have been captured video- graphically, subsequently analyzed by Rapid Upper Limb Assessment (RULA) technique. Before that, Cornell Musculoskeletal Discomfort Questionnaires (CMDQ) were used to collect data regarding musculoskeletal health information of the bus driver. A vibrant co-relation has been observed between the outcome data of CMDQ and RULA. Results yield that the various body segments, such as the lower back, neck, upper arm, lower legs and wrists, are prone to musculoskeletal disorder due to prolonged exposure to bus driving. Analyzed data suggests that the relocation of control elements is ultimately a remedial solution for the drivers by modifying the working environment ergonomically.

Keywords: Musculoskeletal Disorder (MSD), Ergonomic interventions, Cornell Musculoskeletal Disorder Questionnaire, RULA, Bus drivers

Consciousness in Yoga for the Transformation of Human Potentiality

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Abstract: Yoga is an art and science of consciousness. The Yoga Sutra of Patanjali defines yoga as, "stilling the mind and fluctuations of consciousness", the nature of consciousness which is personalized or adopted. It means observing and examining all our conscious mental activities, such as correct information, incorrect knowledge, memory, creative thinking, and sleep. Yoga promotes a broad and necessary method of consciousness, which tends to achieve full potential of mankind, union between individual consciousness and universal consciousness, and the Highest goal of life. i. e. Moksha(Liberation). In terms of human factors and ergonomics, all consciousness activities can be used to improve psychological and physiological principles. It is the practise of connecting with others, such as emotions of relatedness to other animals, the environment, and the cosmos, in order to reduce flaws, enhance productivity, and promote safety and ease. For the living being consciousness is perfectly essential for holistic development of an individual. Upanishads proclaims that the finite and infinite consciousness of living organisms coexists and can control arbitrary and involuntary functions. It is arguably one of the most important towering problem and its mysteries and functions which contain theoretical aspects that go beyond Western psychology to a greater extent. Scientists agree to accept the key role of holistic approach of yoga for promoting better physical, mental, emotional and spiritual health, and the best way to enhance human potentiality at a multidimensional level. This literary study is to explore the applied part of consciousness for transformation of human potentiality.

Keywords: Potentiality, Moksha, Consciousness, holistic, cognition, transformation.

Sustainability: Indian Cultural Heritage through Game Design Concept

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Abstract: Indian heritage monuments are affected throughout the years by a variety of physical and biological pressures. This study explored the potential of game design as a medium that can be designed to sustain cultural heritage and natural history of ancient Buddhist cave monuments in India of various historical eras. Games and simulations can provide an atmosphere in which users can construct new facts of socio-cultural development and creative thinking knowledge integration. This paper is an attempt to understand Indian cultural heritage through the game design concept for preproduction planning, and eventually, enhance Indian enormous cultural and historical values into the domain of public knowledge. In order to validate the relevance of the study, the significant findings were reviewed and summarize the research design approach. Based on the input and discussion with professionals, it was determined that game design concepts based on Indian heritage would certainly provide users with the positive reinforcement they require. Furthermore, such game design with an indigenous prospect can allow users to re-create themselves into a new realm while providing opportunities for meaningful learning.

Keywords: Sustainability, Heritage, Visual Communication, Game Design. Cognitive ideas, Animation.

Design Implementation and Academic Correlation for Harmonizing Contemporary Usage and Heritage of Bodo Traditional Attire

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Abstract: Dokhona, a traditional women's attire of the Bodo Community of the northeast India, marks the community's cultural and traditional identity besides being a ubiquitous dress for daily use. However, in order to cater to the need of (i) convenience in performing daily chores, (ii) ease of wearing from health and safety considerations, (iii) contemporariness of taste and style of dressing, (iv) preservation of the Bodo heritage embodied in Dokhona, and (v) sustenance of traditional looms and cottage industries, the requirement is felt for innovation in the design, production and usage of this dress item. During research on innovative designs of Dokhona, it was found from a status investigation from weavers, users, designers and medical practitioners that elderly people prefer no changes, whereas the younger generation prefers comfort and utility in the context of modern styles of living, and that the retention of the traditional look while bringing in contemporary trends of fashion and feel is important. Additionally, it was found that intervention through academic linkage by designing suitable multi-level programmes, reference the Central Institute of Technology Kokrajhar in Bodoland Territorial Region , could be looked into as a novel approach for up-skilling the traditional artisans and weavers, modernizing the traditional looms, encouraging entrepreneurs and designers, and giving impetus to business development for enhancing return on investment and income of various stakeholders involved with Dokhona. This paper emphasizes innovative ways for motivating young minds through hands-on practice for bringing about sustainability in cultural heritage by rendering versatility and contemporariness in the design of Dokhona through academic interventions.

Keywords: Dokhona, cultural identity, contemporary design, academic intervention

Design of Safety Helmet for Construction Workers and Evaluation Using Digital Human Model

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Abstract: A personal proactive headgear (construction helmet) is important and mandatory for con-struction workers to use during their work. Construction helmets are used both indoors and outdoors. It protects the head from any injury caused due to the fall of stone, brick, tools, etc. As there are different types of construction helmets on the market; however, helmets have multiple problems such as low strength, uneven thickness of the outside shell, incorrect helmet sizes are not based on Indian anthropo-metric data, lack of air inlets, low-quality materials, and unattractive design. This paper attempts to con-ceptualize and compare a helmet design with advanced safety features, comfort, strength, and aesthetic appeal. To achieve the output design process is been used and create multiple ideas. A total of two helmets were conceptualized through brainstorming and concept sketching to achieve aesthetic form. The CAD models for these two helmets were developed using CATIA V5-R19. The ABS (Acrylonitrile butadiene styrene) material is used on a helmet and stress-strain analysis was conducted using the same software to evaluate two concepts. The final concept is further evaluated using CATIA ergonomic DHM (digital human model) to ensure comfort. After analysis, the final selected concept was found to be strong, comfortable, and aesthetically pleasing in terms of masculine, stylish design. The physical model of the helmet needs to be made for better analysis of all factors.

Keywords: Design, Digital Human Model (DHM), Ergonomics, Helmet, Safety

Prevalence of Musculoskeletal Disorders among the Agricultural Workers: A Review

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Abstract: The agricultural occupation is considered labor-intensive because most tasks are performed manually using traditional farming hand tools. These hand tools are not designed ergonomically, resulting in excessive stress on workers and leading to musculoskeletal disorders (MSDs) in the body. This study aims to identify the agricultural risk factors associated with the prevalence of MSDs among farmers. Total one hundred and thirty six articles starting from the year 1985 to 2020 were searched through ePublishers (like Taylor & Francis, Science Direct and Springer) using the keywords such as agriculture, MSDs, ergonomics and productivity. Finally, thirty one articles were selected for the review study that fulfilled the inclusion criteria. Through systematic literature review, it was found that along with the usage and design of hand tools, factors like a repetitive task, awkward postures, forceful exertion, vibration, and exposure to hot weather are mainly responsible for the work related injuries among farmers that leads to severe chronic pain and work disability of workers. Lower back pain, shoulder pain, and cervical pain are the most frequent occurring MSDs in farmers, which are recognized as crucial problems in the agriculture sector that are generally neglected. Hand tool design intervention is more effective in reducing the prevalence of work related injuries in farm workers. It is suggested to apply the principles of physical ergonomics not only in the agriculture sector but also in other industries where traditional tools and working methods are being used.

Keywords: Agriculture, Musculoskeletal Disorders, Ergonomics, Farming, Productivity.

Thermal Performance of Green Roof and Conventional Roof in the Warm Humid Climate of India

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Abstract: The main source of heat gain is through the roof of the building due to the prolonged hours of direct solar radiation. Many studies suggest that green roof is an effective cooling strategy. The studies conducted in Europe, U.S., China and other parts of India yield different performance results due to the diverse geographical location and climatic conditions, which are quite different from that in the warm humid zone of India, and cannot be used as an effective reference. The goal of this study is to establish the thermal comfort characteristics and efficiency of green roof in comparison to a typical concrete roof in the climate of Trivandrum, through simulation and validate it with a scaled model for the months of March, April and May. For this study two cases were considered – a room with conventional roof & green roof. The methodology involves simulation and measurements from a fabricated prototype to find the indoor ambient air temperature and indoor surface temperature of the roofs and its validation. The indoor surface temperature of green roof is on an average 19% less than that of Conventional roof at peak hours. The annual simulation data for Trivandrum, Mumbai and Trichy were crossed compared and the results showed a substantial difference throughout the year which reconfirms that, the green roof is effective in a warm humid climate in terms of indoor comfort, reduction of indoor ambient air temperature during summers and keeping consistent temperature throughout the year.

Keywords: Green roof, Thermal Comfort, Sustainability, Test box, Thermal performance, Passive cooling.

Postural Assessment of Indian Floor Tilers' using OWAS, REBA, ERIN and WERA Methods

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Abstract: Work-related musculoskeletal disorder (WRMSD) is a common health problem amongst construction workers due to working in awkward postures and other related ergonomic risks. Flooring or tilling is one of the major works incorporated in construction where tilers' work in squatting, stooping and kneeling posture for prolong time. The main objective of the current investigation is to study different task carried out during the tilling process, identify the most vulnerable task posture and find the level of ergonomic risk amongst the tilers in India using different ergonomic tools. A total of 30 tilers were observed, interviewed and video recorded for analysis. The tilling work was classified into six tasks and most exposed postures were identified for analysis. OWAS, REBA, ERIN and WERA methods were used to find the level of risk. The tilers have severe pain or discomfort in the lower back (76.67%), knees (76.67%), legs (calf) (60%), arms/hand (43.33%) and ankle/toe (20%). The results of the OWAS, REBA, ERIN and WERA also revealed that the claims of the tilers are true and tilers are working at high to very high ergonomic risk. The finding of the study leads to the conclusion that tilers in India have undoubtedly high rates of work-related musculoskeletal disorders (WRMSD) and are highly affected due to prolong working in squatting, stooping and kneeling posture.

Keywords: Tilers',WRMSD, OWAS, REBA, ERIN, WERA.

An Exploration of Animation Support to Documentary Film for Better Communication

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Abstract: Documentary film is one of the best conventional practice for information preservation and dissemination, and digital technology has expanded possibilities to add on benefits. While looking for further scope, it appears that direct real life shooting based production is lacking in covering many details that was intended to display. To address such creative gaps, the present study looks into inclusion of innovative multimedia content such as 2D or 3D animations that can enhance a specific purpose to deal with details.This deliberation expresses an experiment where a documentary film (narration and direct shooting) was made on a folklore Bardwi Shikla which has been passed on through generations within the Bodo community of North-East India following an oral tradition and it has many finer issues that one needs to internalise with imagination. It was to initially see whether the sentimental details described there in reaches across the community and to others as well. Based on feedback responses on the film after screening to users (both Bodo and non-Bodo origin volunteers) inclusion of animated illustration contents in support of explaining some finer aspects that could not be shown through real life shooting and voice clarification confirms added value towards better communication. A conclusion is drawn that a context specific animation support in digital documentary production could serve both archive as well as add on editing facility for flexibility and better expression of the content.

Keywords: Documentary film, animation support, better communication, folklore.

Analysis of Risk Factors (Psychological and Musculoskeletal Disorders) Associated with Smart Phone Usage among Indian Users

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Abstract: Smart phones have become an integral part of our life. However, excessive usage of the smartphone can affect postures and lead to pain, musculoskeletal disorders, or change in the behavior of individuals. In this study, we investigate the psychological and musculoskeletal issues related to smartphone usage associated with smartphone users in India. Eighty Indian participants were involved in this study. A questionnaire involving 2 sections (to assess psychology and musculoskeletal issues with smartphone users) was developed and surveyed among the participants. RBG pain score was used for rating pain (where 0 designates no pain and 5 designates severe pain). From statistical analysis, 96% of the respondents feel that smart phones are a necessity and not a luxury. 90% of the respondents are happy/ very happy with their smartphones. 85% of the respondents feel that the brand of their smartphones is very important/ important/ fairly important. 31% of the respondents are addicted to mobile phone usage. Respondents using bigger displays (> 5.5 inches) have more pain in their fingers, hand, and shoulders compared to smaller displays (< 5.5 inches) respondents. Respondents using tempered glass display have less pain in their fingers, the base of the thumb, and front of hand compared to tempered glass display respondents. These results indicate that smartphones are a necessity and appropriate ergonomics issues need to be considered and addressed to develop a better design of smartphones that ensure the health and wellbeing of users.

Keywords: Musculoskeletal Disorders (MSD), Smart Phone, Ergonomics, RBG Pain Score.

Determination of Effects of Instrumental Music on Brain Signal using Electroencephalogram

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Abstract: Music plays an essential role in every human being's life. It can stimulate the brain signal of human beings that are accountable for emotion, behavior, and cognition. This association of music with brain signals is the fundamental concept of musical therapy. Musical therapy is a recent trend in neurosciences that is highly beneficial for neurologically disordered patients due to its non-medicinal and non-invasive approach. As each music genre provides a unique change in the brain signal, music therapy utilizes various genres of music for different applications of treatment. This work has examined the effect of the instrumental music genre on human brain signals. Electroencephalogram signals from frontal, parietal, occipital, and temporal lobes during listening to flute and violin instrumental music has been recorded and analyzed to locate the changes in the cortical region. The outcome of this work will emphasize the advantages of the instrumental music genre for musical therapy.

Keywords: Music therapy, Instrumental Music, Electroencephalogram, Cortical Region, Cognitive Activity, Emotion.

Development of Risk Assessment System for Sewing Machine Operators

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Abstract: The prevalence of Work-related Musculoskeletal Disorder in the Ready-Made Garment (RMG) industry is quite common. Due to repetitive actions and subsequent awkward postures, the sewing machine operators are prone to the risk of Work-related Musculoskeletal Disorders- WMSDs, which results in temporary or permanent disability among the operators. The study aimed to develop a Risk Assessment System that identifies the level of risk factors involved and eventually computing the Rapid Upper Limb Assessment (RULA) score of each operator. The discrete posture evaluation of the sewing operators was done by tracking the body joints of the operators using their videos while performing the tasks. Several socio-demographic, psychological, and work-related details were also factored in through a structured questionnaire for testing and validation. In total 72 videos recorded from either side of different sewing operators, were analyzed at the speed of 30 frames per second. A system was successfully developed by applying various machine learning algorithms to compute the RULA score by extracting the different joint angles of the operators like Neck, Upper and Lower Arm & Trunk directly from the video captured. Such a Risk Assessment System developed shall help in understanding the work conditions operators work in and eventually guide in reducing the risk of WMSDs through precautionary measures against the risk. Other benefits may include productivity enhancement, improving overall health, and reducing the rate of absenteeism, which continues to be a major concern among the factory owners and the Ready-made garment industry, in general.

Keywords: Work-related Musculoskeletal Disorder, Ready-made Garment Industry, Motion Tracking, Rapid Upper Limb Assessment, Machine Learning.

Re-learning Puberty: Minimizing Period Shaming in Urban Schools

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Abstract: Misconceptions, ignorance, and lack of awareness regarding menstruation lead to several issues in the urban schools in India, including period shaming. The research enquires into the understanding among the stakeholders: school-going students, parents and teachers about menstruation and its communication issues and offers designs to minimise period shaming. The study analyses the dynamics of mensuration's education, communication and real-life experiences. It employs various design research methods, including in-depth interviews with visual card sorting, semi-structured interviews and focussed group discussions. The research explores the human factors involving school-going children in dealing with culturally challenging issues around mensuration, gender roles and perceptions. It delineates the understanding for design for different stakeholders. It then proposes a multi-point design solution: including counselling sessions, curriculum changes, and an activity kit, 'Peek-a-boo', to re-learn puberty and minimise period shaming in the urban schools. It attempts to expand the emerging discussion on Social Ergonomics and Communication Design.

Keywords: Social Design, Period Shaming, Menstruation, Social Change, Menarche

Development of Mastectomy Bra for Breast Cancer Survivors

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Abstract: Breast cancer is most common cancer among women in India, ac- counting for 25% to 32% of female cancers in all cities across the country. It is estimated that one woman is diagnosed with breast cancer every 4 minutes in India. Mastectomy is one of the most common cancer surgical procedures that cause a change in the look and shape of the breast. Eventually, it causes a major impact on a woman's self-image. Breast cancer surgery and treatment take both a physical and emotional toll. Post-surgery, women have to deal with another hitch in the pot – a lingerie wardrobe that no longer works for their new body. Thereby, generating a need for post-surgical products i.e. mastectomy bra and prosthesis as a part of the healing process and a return ticket to one's normal lifestyle. The research was conducted on a focused group of cancer survivors in India to develop a solution in the form of a mastectomy bra. The purpose of this research was to understand the challenges and the design requirements of breast cancer survivors concerning mastectomy bras. The user-centered design approach was applied to develop prototypes for a range of mastectomy bras based on information gathered through primary and secondary modes. In this research, four novel mastectomy bra designs were created addressing the needs of this very specific user segment. This research paper entails a step-by-step process of product development following a user-centered design approach. The research resulted in developing a satisfactory solution (mastectomy bra) for the users.

Keywords: Breast cancer survivors, Ergonomic Mastectomy bra, User-centered Design (UCD), Product development, Shoulder immobility, Body posture correction.

A Systematic Review of the Effects of Noise Characteristics on Human Mental Performance

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Abstract: There is a substantial effect of noise on human performance, especially for the tasks involving visual and mental concentration and/or cognition. This study aimed to systematically review the available literature related to the effect of noise on human cognitive performance. The literature search was performed on four electronic databases, including PubMed, Web of Science, ScienceDirect, and Google Scholar, and after applying the inclusion/exclusion criteria to 147 citations, 31 articles were finally selected for review. While exposure to noise had significant effect on the human cognitive performance, the size of the effect considerably depended on the nature of the noise and characteristics of the task. The noise type, frequency and intensity level were found to be the significant factors that influence human cognitive task performance, in terms of reaction time/time taken to complete a task and/or the count/percentage of errors. However, there is a limited research that evaluated the interaction effects of the noise characteristics on human cognitive performance. Hence, a more comprehensive research towards understanding the interaction effects of noise characteristics on human cognitive performance may be recommended.

Keywords: Noise, Cognitive performance, Noise type, Noise intensity, Cognitive ergonomics.

Potential Benefits of Corporate Social Responsibility (CSR) In the Construction Industry

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Abstract: Corporate social responsibility (CSR) is becoming more prominent as a core plan for the construction industry and its businesses, which is most likely motivated by two important quandaries that represent the construction industry's distinct characteristics. Various aspects of social well-being, such as cultural events, environmental, economic, and safety and health are influenced by construction activities and built facilities. According to the previous studies, being socially responsible enables construction companies to gain a long-term competitive advantage and improve operational efficiency from an industrial viewpoint. This paper intends to include a systematic review of CSR studies in order to recognize and actualize the potential for CSR implementation by construction sectors. The results have implication for construction companies' trending CSR activities in reaching their target of being socially responsible and improving competitive companies reward.

Keywords: Corporate Social Responsibility, Construction, Benefits, Review, CSR

Preliminary Survey in FMCG Shop-floors to Understand Operational Activities for Identifying Ergonomic Stressors: A Case Study from North-east India

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Abstract: Fast Moving Consumer Goods (FMCG) industries dwelling on high-paced assembly-lines and highly-repetitive short-cycled work producing high volume-low cost products under Just In Time (JIT) production process contributes a lot to every country's Gross Domestic Product (GDP) and employment generation. Supported by various government schemes and initiatives, the FMCG industries flourish throughout India, and north-east India is a prominent hub for FMCG business houses. Traditionally, the FMCG manufacturing units built upon the pre-defined plot sizes provided in industrial parks lack the thorough consideration of ergonomic aspects within facility layout planning and other machinery installation early from the commissioning phase. It affects productivity and leads to other Occupational Health and Safety (OHS) issues. Considering the FMCG industries' significant role in the Indian economy and society, the researchers conducted an in-depth survey of the FMCG industries (located in north-east India) to understand the operational activities and identify ergonomic stressors which hampers the overall productivity and safety. During the field visits and survey, it was observed that there is an immediate need for thorough ergonomic consideration in implemented Kaizens, standardization of work activities, and implementation of context-specific tools for the FMCG work. Detailed ergonomic studies are further required to propose context-specific ergonomic interventions, which may be behavioral, organizational, or design-related. Such interventions will prove beneficial for promoting better OSH and thereby improved efficiency and productivity.

Keywords: ergo-audit, industrial shop-floor, Kaizen, lean manufacturing, WMSDs, OSH, safety, user -centered design

Analysis of Body-Gestures Elucidated through Elicitation Study for Natural Locomotion in Virtual Reality

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Abstract: Proxy gestures are a powerful input interaction method for travel in virtual environments (VEs). Gestures provide an alternative mode of interaction for a design that is more natural and intuitive than the controller-based methods. A key challenge lies in understanding the patterns in the gestures and the relevant user behavior while performing the gestures in a specific scenario. In this paper, we classify and analyze the full-body travel gestures that were obtained as a result of our previous elicitation study. The travel gestures were performed in a seated position by 40 participants for 3 different VEs (VE1,VE2 and VE3) where the task of virtual travel was combined with placement task. We observed a total of 405 gestures and identified 24, 24, and 9 unique full-body gestures for the three different VEs respectively. We categorize them into upper body and lower body gestures. We further classified them based on hand usage and gesture form. The results indicate that *static pose and path* form was predominantly used in VE1 and VE3, *static pose* and *static pose and path* form was used in VE2. The findings also indicate that as the multitasking level increased in the VE, the usage of *dynamic pose* and *dynamic pose and path* form decreased. From the analysis, we obtain a better understanding of users' thoughts and behavior while performing the gesture. Using our results future designers and developers can identify suitable gesture categories for task-related to virtual travel in a seated position for multitasking scenarios.

Keywords: Virtual reality, locomotion, virtual travel, gesture classification, body gestures, gesture elicitation study.

Driver Behaviour as An Influential Factor for Enhanced Long Distance Bus Travel Experience as Applied to Elders Doing Pilgrimages – A Survey Based Study

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Abstract: One of the most influential factors for the overall satisfaction of long distance bus travellers is the interaction between passengers and drivers. This paper tries to find an answer whether our drivers really aware of the needs, apart from their professional (driving) training, on behavioural issues especially attitudes towards their passengers particularly elders' requirements. An ergonomic survey was conducted on 30 long journey pilgrim buses of different routes with a total journey duration of 2-7 days continuous with night halts en-route and per day travel time of 6-10 hours with mini breaks in between. A set of questions was floated to find answers related to four different aspects viz.1) satisfactory driver behaviour (cordial and interactive), 2) Do the drivers are well versed about the journey details and destinations. 3) Willingness to help on various issues as and when required and, 4) Comfortable and smooth drives without jerks while accelerating and decelerating, and was enquired on 30 passengers for each driver (selected with purposive random sampling). The number of drivers was also 30. Hence in total 900 respondents were surveyed. Responses were recorded with a five-point Likert scale towards framing a possible behaviour guideline. The results suggest that a set of remedial knowhow to handle psycho-social and physical issues relevant to elderly passengers can be framed out and drivers may be given refresher training on special care requirement; It is expected to enhance rejuvenation of travelling spirit in spite of the gradual deterioration of physical capability of senior pilgrims.

Keywords: Long distance bus travel, driver behaviour, elderly pilgrims, inclusive bus travel

Comparative Visual Analysis of Brick Architecture Ornamentations of The Ahom Monuments in Sivasagar, Assam, India

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Abstract: Assam has a rich history of the Ahom dynasty for 600 years. With the first Ahom King Sukapha (A.D. 1228–1268) leadership, they set up their first capital in the Charaideu district of Assam. As for which, most of the Ahom architectures are observed in and nearby Sivasagar and Charaideu area of Assam. Most of the Ahom monuments are preserved under the Archaeological Survey of India (ASI), Assam and Directorate of Archaeology, Guwahati, Assam. These monuments were constructed using mostly bricks, stones and mortar. Noticeably, the ornamentations in the brick monuments have managed to survive in fragments and sections; this is due to the effect of natural causes and the climatic condition of the environment. In some cases, the restoration process reduces the ancient aesthetic due to lack of understanding of the underlying design principles of ornamentation. Most historians and scholars have studied the iconography and archaeological findings of these monuments; the study on Ahom architectural ornamentation is significantly less. A pilot study was conducted to identify the surviving ornamentation in brick architecture monuments. Based on the identification, a categorization theory has been adopted to segregate the data. The categorization is based on the architectural sections of monuments that primarily includes motifs and pattern types. This paper identifies and compares the visual elements of ornamentation using formal analysis. It discusses the underlying design principles of ornamentation. The results and analysis of this paper provide a significant contribution to the conservation of traditional art and early architectural ornamentations.

Keywords: Ahom Architecture, Ahom Motifs, Archaeology, conservation.

An Ergonomic Evaluation for Designing Workstation for Fish Vendors

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Abstract: Fish and seafood has a significant impact on local culture and economy. The main activities of fish vendors like carrying, weighing, washing, scaling, and cutting are manual in nature including high physical workload. Previous studies revealed that 50% of fish vendors suffered from Musculoskeletal Disorders, 35% from fish handler's disease & 60% from skin diseases. Therefore, the implementation of ergonomic principles in the workstation of fish vendors is an important part of comprehensive health and safety processes as well as to improve worker's productivity. The present study is focused on analyzing the existing workstation of the fish vendors and to minimize work related disorders. The study also proposes a concept design of the workstation to improve worker's productivity. The data was collected in Gariahat Fish Market, Kolkata, West Bengal, India. Modified Nordic Questionnaire, RULA analysis and Quick Exposure Checklist (QEC) were used to evaluate ergonomic risk factors associated with the level of exposure to Musculoskeletal Disorders (MSDs). Result shows that 59.37% experienced pain in hand & wrist, 37.5% experienced pain in lower back, 31.25% experienced pain in their neck, 100% had cuts, 90.6% vendors confirmed that their skin was directly exposed to ice and most of the body parts are in high exposure level to MSD. The proposed design of the workstation would not only incorporate most of the work related problems but also make their work more efficient and productive.

Keywords: Workstation Design, Posture Analysis, MSD, Anthropometry

Ergonomic Evaluation of Workstation Components in Work from Home Settings During COVID -19 And Its Correlation with Musculoskeletal Symptoms: A Self-Reliant Approach

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Abstract: Covid-19 has mandated work from home and has brought to focus more personal responsibility towards health and working environment. This is a bigger challenge considering the dearth of knowledge on ergonomics and resources for an appropriate work-station set-up. The sudden rise in the reported musculoskeletal discomfort is consistently described in various recent studies. The early intervention strategy may be to identify the lacuna in the work setting by making individual self-reliant in evaluating their respective work-stations. This study was conducted with an objective to document self-evaluated computer workstation components in work from home settings and correlate these findings with reported musculoskeletal complaints. A cross- sectional survey was conducted using Google form structured using guidelines from "Computer Workstation Ergonomics: Self-Assessment Checklist by the National Institutes of Health, Office of Research Services, Division of Occupational Health and Safety website and Nordic pain questionnaire, used to identify the musculoskeletal symptoms. 238 people volunteered and completed the survey form. A significant negative correlation was observed between Computer Workstation Ergonomics: Self-Assessment Checklist scores and VAS score ($r= -0.386$, $p<0.01$), and with areas of discomfort ($r= -0.292$, $p < 0.01$). Work-related musculoskeletal discomfort at work from home settings is associated with inappropriate design, non-availability of peripherals to fit the work station and simpler adjustments as reported via structured self evaluations by workers. Active self-reliant worker empowered to address ergonomic needs could be a valuable strategy during the pandemic.

Keywords: Work-related musculoskeletal discomfort, Self-evaluation, Work from Home, Ergonomics, Covid-19, Self-reliant approach

Participatory Design of a Computer Mouse

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Abstract: Intensive use of the computer mouse is associated with an increased risk of musculoskeletal disorders. Due to prolonged use of the mouse with a wrist posture that deviated from its relaxed posture, users may experience fatigue, discomfort, and even pain on the wrist and hand. Both size and shape of the mouse can be a cause of this associated discomfort. In this work, we have followed a participatory-design approach to propose a design concept and develop a vertical pointing device prototype that offers a comfortable right-handed grip that resembles the relaxed hand posture. This work aims to understand user participation during the design process and how their involvement helped evolve the device concept that enables comfortable grip and novel interaction opportunities. We started the participatory design process using clay mockups to finalize the initial shape. After finalizing the initial shape, we made further modifications based on user feedback. After two iterations, we completed the design and conducted a user study to investigate perceived comfort and pressure on the wrist. We found that the grip on the device was comfortable for participants with medium and large hand sizes, and the majority of them reported no pressure on the wrist. The device allows users to keep their hands in a more ergonomically desired posture. It offers novel interaction modalities as an alternative to the button-based controls of a typical computer mouse. We believe this work will help interaction designers and researchers design ergonomic pointing devices enabling multimodal input interaction.

Keywords: Participatory design, vertical pointing device, ergonomic mouse.

Contributing Towards Blue Economy with Ergonomic Assessment of Musculoskeletal Disorder (MSD) Among Workers Involved in Harvesting Living Resources

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Abstract: Blue Economy is a marine-based economic development leading to improved human well-being and social equity. One such area is the harvesting of living resources, which requires different processes involving manual material handling. One such process is loading large quantities of crates filled with fish and ice to the truck. Repetitive work involving heavy lifting and bending results in the development of musculoskeletal disorders among the workers. The purpose of this study is to identify the health risks involved in this occupation and ultimately aid in the direction of improving the lives of the workers. Nordic questionnaire, Dutch Musculoskeletal Questionnaire (DMQ) and observation study was used to identify musculoskeletal disorders and potential work hazards the workers are exposed to in the fishing industry. A total of 30 workers were selected for this study. In total, 84 % reported complaints in Lower back, 76% complaints in shoulders, and 89.6 % of the workers reported complaints in Wrist during the past 12 months. Among all workers, 45% visited a physician at least once, and 30% took at least one period of sick leave. The potential work hazards were found to be repeated motion, work involving bending, lifting and wet and cold grip. Working conditions involving cold and wet grip and repeated lifting and bending motions for long hours are important risk factors for the development of MSDs among the workers working in the fish crates loading process, and thus these risks have to be eliminated with effective intervention in this area.

Keywords: Blue economy, Fisheries, Musculoskeletal disorders, Manual material handling.

Identification of Ergonomic Problem of Paddy Harvesting Due to Climatic Change at Small Scale Farms of Kerala, India

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Abstract: Due to change in environmental weather condition and global warming for the last few years, giant tropical cyclones causes' massive damage to paddy crops mainly in the southern and eastern parts of India. Extensive damage to the crop by the cyclone and non-seasonal heavy rainfall causes enormous eco-nomic losses and crop reduction. Paddy harvesting is mainly done by female agricultural workers of south-ern India using traditional sickles. The time, effort and cost of harvesting paddy under these environmental conditions are double compared to regular paddy harvesting. Work-related musculoskeletal problems among the farmers due to paddy harvesting for changed weather condition is very high. An interview and questionnaire study was conducted among 28 agricultural workers to understand the existing ergonomic problem of paddy harvesting in these change environmental conditions. For data collection, small scale paddy farms from two districts of Kerala were selected in which harvesting is done in two different sea-sons. One place is rain-fed and the other is irrigated. The workers selected in this study reported pain in the upper arms and lower arms, followed by back and lower limb pain due to prolonged forward stooping and squatting posture due to harvesting lodged crops. This study will be helpful to draw insights into ergonom-ic problems in paddy harvesting in small scale farming with changed environmental weather conditions.

Keywords: Heavy rainfall, WMSD, climatic change, paddy crop harvesting.

Perception and Continuous Intention of Wearable Fitness Trackers Among Different Age Groups: En-Route Towards Health and Fitness

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Abstract: There is a significant societal change in the world with the growth in the ageing population. Older adults are likely to accumulate some health sternness with age, often leading to the functional disability with time. Assistive devices are an excellent resource in such cases, but independence is compromised to some extent. However, wearable fitness trackers (WFT) play a significant role in motivating people to indulge in a healthy lifestyle avoiding vulnerabilities in the old age. Despite the sales of WFT being large-scaled, it faces challenges in its sustainable usage. This paper discusses the various challenges faced by older adults through the ageing process. Correspondingly, it addresses the effects of health and fitness intervention in the enhancement of their living standards. It highlights the methods and results of the study conducted on people aged between 18 and 75+ years towards the Behavioural and Continuous Intention of WFT. As a solution, the paper highlights the positive prospects of WFT as an essential tool towards health and fitness and methodically addresses the sustainability issue concerning its acceptance and Continuance.

Keywords: Ageing, Fitness, WFT, Expectation Confirmation, Continuous Intention

Influence of Age and Ability Sensitive Ergonomics on a Workplace Design

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Abstract: An ambient built environment is crucial for a universally designed physical space that significantly encourages the user's performance. Universal Accessibility is of prime importance in Architectural studies. A well-designed workspace should be friendly in terms of age and ability by taking the user's anthropometric capabilities and limitations into consideration. However, Effective evaluation of workplaces is an emerging trend that influences people's physical and behavioral performances since the working class spends a handsome amount of time at work. This research aims to heuristically evaluate the design of office spaces primarily concerning factors of age and ability-sensitive ergonomics. Professionals with specializations in Architecture, Planning, Engineering, Design were deemed as evaluators. These evaluators from different age and ability groups were targeted during an 8-hour work shift. The methodology is formulated through 5 stages namely Literature study, Quessionaire formulation, Analysis, Results, and Discussion. A questionnaire survey was conducted for assessment of the perceived levels of importance and user's satisfaction with their workplace environments based on the achieved mean ratings and importance index values. The evaluation criteria were designed by taking spatial design parameters, ambient interior, and passive design into consideration. Further, the users had to choose from predefined scenarios with varied distribution levels of parameters chosen. A user ergonomics modeling has been carried out on the scenarios for developing a convenient working environment, thus increasing all users' overall productivity. The results show that the ergonomics based on these parameters can efficiently evaluate and draw conclusions for designing an inclusive work environment.

Keywords: User-sensitivity, Inclusive Workplace, Accessibility, Institutional Productivity

Impact of Acoustic Distraction and Overcrowding on Cognitive Performance of Healthcare Professionals

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Abstract: Overcrowding and acoustic distraction often affect the cognitive performance of healthcare professionals. They often find it very disrupting and challenging to focus on their tasks because of the chaotic work environment. Health camps are a time-constrained affair, and the healthcare experts have no control over the work environment. They face a higher rate of interruption in the health camps when compared to their usual clinical settings. These trigger a sense of anxiety in their already demanding workload. The current research investigates how overcrowding and acoustic distractions escalate cognitive load among healthcare professionals. A field study was carried out in seven (07) different health campsites, and the perspectives of Thirty-seven (37) healthcare professionals were captured. A walkthrough survey, interview, and questionnaire were used in the study. Most of the respondents mentioned that they undergo intense stress and distraction due to the demanding nature of work at the health camps. Congestion of the patients at the health camps and acoustic distractions hampers their ability to work optimally. Lack of patient management system and uncontrollable physical work environment disrupts the professionals throughout the health camp. The results provide insight into how acoustic distraction and overcrowding at the health campsites act as barriers to imparting safe and high-quality healthcare. Interventions aimed at reducing the cognitive load and increasing the efficacy of the healthcare workers have been proposed to overcome these barriers.

Keywords: Cognitive Performance, Acoustic Distraction, Overcrowding, Health Camps, Cognitive Load.

Identifying Ergonomic Issues and Re-Designing of Mango Plucking Tool

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Abstract: Alphonso mangoes are harvested in Konkan region of Maharashtra and has significant impact on economy of local farmers. Alphonso mango harvesting is carried out by conventional methods which needs a huge labour effort. This study consists in-depth research of various methods carried out in Alphonso mango farm. Interviews, field research, photo and video ethnography, ergonomic study for body postures, task analysis has been done for understanding issues in conventional methods. Mango harvesting needs systematic management and well-trained labours to identify and sort mangoes according to its quality. Design intervention is necessary in conventional tools used for mango harvesting. According to research conducted for this case study, it is found that mango plucking is critical and most important stage in mango harvesting. However due to factors like aerial distance between mangoes and labour, difference in lightning conditions, change in size and shape of mangoes It is difficult for labour to identify which mangoes are ready for harvesting. Improper plucking affects ripening process of mangoes. Traditional mango plucking tool is made up of blade and bamboo or steel pipe. This plucking tool is re-designed with ergonomic considerations and use of modern technologies to identify harvesting stage of mangoes while plucking them. Automation and re-designing of this mango plucking tool will improve accuracy and saves time and efforts required by labour.

Keywords: Ergonomics, Agriculture, Alphonso harvesting, Mango plucking, Automation, User experience.

Identification of Ergonomic Risk Factors in Dhokra Bell Metal Handicraft Industry of Chhattisgarh, India

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Abstract: This paper presents an ergonomic assessment of risk factors involved with the bell metal handicraft processing industry of Chhattisgarh, India. Bell metal casting is one of the ancient traditional handicrafts practiced in India. In Chhattisgarh, Ghadwas tribe group were involved with this craftwork from ages and used the term "Dhokra". This craftwork is recognized worldwide for its unique style of metal sculpting and ornamentation process. For centuries this craftwork survived with many challenges, and the rich knowledge of craftsmanship was passed down from one generation to the next. In this survey 120 artisans participated, of which 60 were females and 60 were males. The survey was divided into two phases (1) Identification of the ergonomic risk factors in the existing workplace. (2) Prioritization of the risk factors. In the first phase, modified Nordic questionnaires, RULA, REBA and OWAS techniques were used to identify the problems in the existing workplace. In the second phase, the risk factors were prioritized by comparing data techniques to mitigate high ergonomic risk in the existing workplace with proper action plans. It revealed that artisans faced posture-related Musculoskeletal disorders (MSDs) during crafting activities. Through analysis and observation of the result it was concluded that artisan's health mostly affected by improper body posture, workload and unorganized nature of work. The crafting process forced to work in wrong posture, increasing overall discomfort and pain. Moreover, it suggested that ergonomics intervention in tool, work process and workstation design will be helpful to prevent MSDs.

Keywords: Ergonomic risk assessment, Bell metal handicraft industry, RULA, REBA, OWAS, MSDs.

Ergonomic Study in Information System Design of Two Major Railway Platforms of India

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Abstract: Over the decades, passenger's desire to enjoy a relatively better-quality service by most popular transportation system of India that is Indian Railways. This paper aims to investigate about existing information amenities on railway platforms and find the suggestive measures to improve it, to meet with the aspirations of the passengers. The study was conducted on two major railway platform of India, Nagpur Junction and Patna Junction. Data was collected through structured and unstructured questionnaire from different stakeholders: passengers, railway officers, staff and railway station vendors. Crowd flow in the peak hours and normal hours were observed by direct observation and through video graphic method to understand the quantum of the problem at these two railway stations. The results of questionnaire and observation study on stakeholders reveals role of information system design to make the platform congestion free and provide better travel experience and quality services to its passengers. This study will be helpful in the identification of the scope where design intervention can be accommodating for a better passenger travel experience.

Keywords: Travel experience design, Information system design of railway platform, Service design

Effects of Built-Environment Attributes on Workplace Psychology & Productivity

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Abstract: There is continuous interaction between humans & built-environment and hence it affects humans. Humans experience the built-environment through their senses and since it is created by us, it becomes imperative to design it consciously. Objective: To study the impact of the built-environment on the comfort, well-being, and productivity of humans in workplaces. Work environment plays a very crucial role as it affects mood, happiness, wellbeing, and performance of its inhabitants. It's said that finding right place to live and work can greatly help with improving happiness. Architecture has the power to allow or inhibit humans to act, behave & think. This research attempts to analyze the relationship between human productivity and architecture and how built-environments can limit/enable humans. Methodology: The study identifies key physical parameters affecting human productivity by compiling and analyzing various research done in the past 30 years. The impact of identified parameters has been further studied by conducting two primary case studies. One compares the built-environment of two offices of a national daily and compare it with the self-assessed productivity and satisfaction levels, keeping variables like work culture constant. Further, an open survey has been conducted with 110 respondents to draw correlations. Analysis has been done using basic social statistical tools including methods of correlation and regression. Findings: It has been observed that the built-environment does impact human productivity. Thermal comfort, lighting, perceived health and hygiene, ergonomics, basic building amenities, aesthetics, and ease of work have been found to have a significant impact on perceived productivity.

Keywords: Productivity, workplace, built-environment, comfort, wellbeing

Design and Development of Hand Tools for Metal Handicraft in Context of Adoption

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Abstract: The innovation of machine tools has had a major impact on productivity in the manufacturing industry. In design interventions on manufacturing equipment, craft adds value to productivity and quality. A major problem faced by artisans in the cottage handicrafts industry is the adoption of technology so as to maintain competitiveness in the global market. There are some barriers to the adoption of advanced technology - lack of access to technical information, unavailability of technically qualified persons to operate the new technology. This research has been done to fill the technology gap in the cottage handicrafts sector through the design and development of appropriate equipment. Currently the tools have evolved from blending the expertise and experience of artisans with modern technology. Survey of Assam State Brass Metal Handicrafts sector of India has been considered for this research study. This includes the study of relevant information through direct demonstration of work performance, equipment, work posture and environment, advice from skilled artisans. The process design set up for the devices is safe and easy to operate and increases productivity time and cost in the long run.
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Keywords: Brass metal handicrafts, design intervention, Hand tools, Production, Productivity, operation management.

A Smart Compact Kitchen Layout to optimize Space Utilization

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Abstract: The present work demonstrates the development of a compact kitchen design prototype in the Indian context. With smaller spaces, nuclear families and busy lifestyles, the cooking experience needs to be more efficient and pleasant. The aim of this work is to create a compact, ergonomic kitchen layout with optimum space utilization which should be low maintenance and safe to use, and it should suit the ever-changing lifestyles of the elderly, bachelors, and working couples. The study's methodology included three components: a survey, ergonomic analysis, and design considerations. By analyzing primary and secondary data, user need statements were developed. Mission statements were used to set goals for the design. Mind mapping and concept sketch were employed for the initial ideation cycle. The second ideation cycle was used to visualize the space in three dimensions by building CAD models of the concepts. Finally, in the final ideation cycle, these concepts were screened and modified, resulting in a CAD prototype of the final concept. The major components of the kitchen include the work triangle, cabinet storage and counter space. All of them are incorporated into the design, making it sufficient to fulfill our daily requirements. The proposed design can meet the basic requirements while using the minimal space and maximizing functionality. It will suffice for nuclear families and small households serving one or two people per meal. The design is proposed to be employed in temporary set-ups in disasters and medical emergencies.

Keywords: Ergonomic, Compact kitchen, Work triangle, Elderly, Efficiency.

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An Improved User Interface for Enabling Smart Access Using Low-Cost QR Based Systems

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Abstract: Organizations of today are scrutinized for neglecting safety and healthcare of their employees The entry/exit points witness rigorous human contact and are hotspots of germ transmission by touch. In this paper, we propose an authentication method for physical access control by using a Quick Response (QR) Code Powered Setup. This low-cost method facilitates quick implementation by only requiring the smartphones of its employees. The main motive is to help organizations in tracking and prioritizing the safety of its employees when entering the organization and facilitating seamless human resource management. This system uses an encryption algorithm that assures a secured flow of the programmed events, avoiding any external mal-hindrance. The QR code is transmitted through a carrier network, thus enabling faster operations. The estimated duration between scanning and verification is approximately 2-3 seconds before the barricades get unlocked. This system is feasible for accessing gadget/tokens in semi-restricted public places and venues demanding a record of individuals using their services. QR code reading is unambiguous, as it only demands proximity of the reader device to the user's screen, thereby trenching any chances of fallacy. This technology is proficient and expedient in ways such as higher data storage capacity, curtailed implementation cost, technical simplicity, extensive use, and is globally available. Varied compatible sequencers and extraneous features can be accumulated in this ecosystem. The proposed system is demonstrated with a simple UI that can be upgraded in scale when implemented. The validation of the proposed system is measured with the SUS scale among a set of users.

Keywords: Smart technologies; smart lock; QR based system; User tracking, Occupational Sectors (Informal and Organized)

Eye-tracking to Evaluate the Usability of User Interfaces

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Abstract: User Interface is that part of the equipment with which the user communicates with the product. These user interfaces are the buttons, touchscreen, knobs etc. These should be designed in a manner that every user can use it efficiently. But in reality, the users are having a fear to use it. In the present study it was found that among all the equipment's respondents were having a fear to use the microwave oven because of it complicated user interfaces. While using the microwave oven the users are facing lot of problems which are related to buttons, knobs, switches, touch screen, etc. of user interface. Ninety per cent of the respondents stated that there are too many buttons in the interface and 100 per cent reported that the buttons are a waste of space. Forty-five per cent of the respondents reported that there is a bad contrast between the keys and the equipment same percent stated that the font size is not legible and 90% reported that the distance between the keys are not sufficient to operate it smoothly. Thus, the usability is dependent on text style, location, size, colour and visual information of the components in the user interface. When these attributes are used effectively users use the product without any problem. The need of the hour is to study the usability problems while using the products. In usability evaluation, today eye tracking methodology is mostly used which can be a guide to improvement in design of user interface.

Keywords: User Interfaces, Usability, Eye Tracking

Interrelation of Multiple Intelligences – An Approach to Enhance Learning

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Abstract: Howard Gardner's multiple intelligences (MI) theory claim that the capacities of every individual are unique due to the range of different intelligences possessed by them. The theory has been widely accepted but, there are still gaps in its application (Liu, 2008). Variations that prevail within the learners should be recognized and acknowledged, so as to enhance learning. This paper investigates the types of intelligence possessed by 120 primary school children of age 8 to 11years. It focused on determining the inter-correlation among the seven variables of intelligence theory. Both quantitative and qualitative methods were used to collect information from the samples. The results indicated that the number of children who possessed bodily-kinesthetic and spatial-visual intelligences were more as compared to other types of intelligences. Correlation analysis revealed significant positive correlations among the intelligences, except Intrapersonal-Bodily-kinesthetic and Intrapersonal- Interpersonal intelligences, which were found to be negatively correlated. Further the results of an exploratory factor analysis revealed three factors - F1 (Spatial-visual intelligence, Logical-mathematical intelligence, Bodily-kinesthetic intelligence), F2 (Music, Linguistic) and F3 (Interpersonal, Intrapersonal) that grouped the variables. The findings indicate that recognizing the profile of intelligence is extremely important, since one type of intelligence support the other.

Keywords: Multiple intelligence; types of intelligence; inter-correlation of intelligence.

Photography is a Tool of Social Awareness

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Abstract: Photographs are an essential medium for raising human awareness. Proper use of photography is crucial for raising social awareness. The field of visual communication has emerged political communication, advertising, information, and other media effects. As a result, one of the primary reform initiatives of the Government revolves around spreading awareness through photography on various social issues. In this situation, it may be stated that visual communication mediums like posters, banners, and hoardings play a significant role in enabling such initiatives to develop social awareness at a larger scale across the society. A photograph is a long-lasting and a significant tool for spreading the message to the target group; the awareness campaigns by the Government sizably depend on such a medium to reach out to a large number of audience. Photography has often promoted the social interests of people. Communication is the action of sharing ideas and information as well as the exchange of knowledge, attitude, and feeling between two people or a group of people. The study confirms that combining images and text with a sentiment attached to it for a social campaign, may get better acceptance.

Keywords: Communication, Photograph, Poster, Awareness.

Workload Assessment Methods on Train Station Control Room

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Abstract: Workers at the train station control room undergo a tremendous mental workload. The job demands multitasking which can put a lot of strain on the staff. Mental as well as the physical workload on workers in such scenarios can be calculated using Nasa TLX (Task Load Index) is a broadly used, intuitive, multifaceted assessment tool that rates the perceived amount of effort so as to assess a function, organization, or unit's efficacy or other facets of attainment or using SWAT (Subjective Workload Assessment Techniques), a workload assessment method that asks subjects to rate the workload of a task based on the size of the time exposure, the exposure to mental exertion, and the exposure to psychological stress. Cognitive based ergonomic solution will be also given to reduce the mental workload will thus enhance productivity, improve efficiency and reduce errors. Finally, through Nasa TLX it was found that workers face high mental workload and through SWAT it was known that the workers undergo a high time load.

Keywords: NASA TLX, SWAT, Train station control room, productivity, mental workload

A Village in the City

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Abstract: Understanding the significance of quality of life has become important these days which eventu-ally has led us to the rediscovery of public spaces (both rural and urban) and their inter-relationship with the restoration of human dimensions in everyday life. We have realized the importance of social inclusions and connections in all these spaces with the intent of recognizing the importance of creating a sustainable environment model which will eventually contribute to the overall quality of life on this planet.
With this intent and changes in the societies over time, it has become necessary to create more flexible spaces that support community participation to help in interacting better with the natural environment as well.

This particular paper delves into understanding the vital relationship between urban open spaces at the neighborhood level and their users which include components like physical and social factors which define them.

Developing a framework to understand the concept of a self-sustained community and its need has long been recognized. However, we still fail to incorporate such concepts at the city level because of various constraints. We need to relook into successful village models in India and abroad and study the parameters in details of its self-sustainability concept. A comparative analysis can be further done to assess if a village model could be replicated at the urban neighbourhood level with the participation of the community by identifying gaps and using sustainable indicators to bring out a successful urban model.

Keywords: Sustainable environment, Community participation, Neighbourhood, Self-sustained communi-ty, Human Environment Interface (HEI), Human factors.

Design, Development and Performance Evaluation of Foot Operated Elephant Apple Core Cutter

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Abstract: Elephant apple has been found to contain various medicinal and pharmacological properties but due to limited processing technique its utilization is limited. This study was conducted with the objective of developing a mechanized foot operated elephant apple core cutter with an ergonomic design to reduce stress and require minimum amount of strain. The cutter was designed and developed by considering the physical properties of elephant apple where the core cutting is accomplished by mechanical coring of the elephant apple placed in a horizontal plane. The cutter consists of four unit's viz. frame, cutting base, coring unit, and pressing unit. The cutting base and coring unit contacting elephant apple are made of food-grade stainless steel. Mechanized cutter performance has been evaluated in terms of capacity, machine efficiency, and loss percentage, etc. and was compared to that of the conventional cutting method. The average cutting capacity of mechanized core cutter (MCC) was about 115–130 kg/h compared to that of conventional method with 13–17 kg/h. The mechanized cutter also offered higher sepal yield (85.55 ± 1.81%) compared to the conventional method (64.23 ± 2.43%) indicating the overall performance of the mechanized cutter to be far better than conventional method in terms of quality, quantity and stress involved. This cutter proved to be ergonomically sound, less likely to cause muscle strain, and consistent with the users' desired position.

Keywords: Ergonomic, Musculoskeletal Disorder, Mechanized Core Cutter (MCC), Cutter Efficiency

Analysis and Improvement of Working Postures in Cargo Securing Process During Outbound Shipment by Using Different Ergonomics Tools and Software

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Abstract: The main objectives of this study were to identify the most problematic postures in hammering tasks performed at outbound shipment process within logistics through application of the computerized Classic Jack Software and Ergonomics analysis tools such as Rapid Entire Body Assessment (REBA), Safety and Ergonomics Risk Assessment (SERA) and Rapid Upper Limb Assessment (RULA) method, and to develop recommendations for improvement of working methods and workplaces. The manufacturer exports the product through sea containers, and it is very important to secure the product inside the container by nailing and lashing operation so that product will not get damaged during transportation. The lashing and nailing operations are required to secure product inside the container and both are below the knee level operations which are ergonomically not safe. The outbound shipment process ergonomics and productivity is improved by eliminating hammering operation and inefficiencies in the container loading and unloading process through designing the unique self-locking pallet which doesn't need any securing operation like nailing and lashing. The "Lean and Triz" are employed to solve problems and improvements were recorded. The container loading time is reduced from 53.4 minutes to 28.4 minutes for palletizing shipments hence productivity improved by 46.81%. SERA score reduced from 48 to 1. REBA score reduced from 11 to 3. RULA score reduced from 7 to 2. The overall increase in the productivity of outbound shipment by ~47% and reduction in the ergonomics risk to bare minimum.

Keywords: Logistics; Ergonomics; REBA; SERA; RULA; Productivity.

Digitizing the Street Vending Market

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Abstract: Fuelled and pumped by liberalization policy and incoming Foreign Direct Investment (FDI) funds, the Indian market's retail sector has become highly dynamic. The organized retail backed by technology and infrastructure is posing a great challenge to unorganized retail. Unorganized retail is not able to compete with them due to the paucity of funds and infrastructure. It is severely affecting the social structure and occupational well-being of the unorganized retailers, especially the street vendors. There lies a dire need to equip them with modern technology-enriched low-cost design interventions that may empower them to compete with the organized retail. Several researchers have advocated the need of designing and developing context-specific design interventions as a mitigating solution. In this research, the authors have proposed a low-cost vending cart that is enabled with a system for automating the inventory and billing facility to digitize the street vending market. It can empower the street vendors with technology-rich features installed within their existing infrastructure to sustain and dwell well in modern cut-throat competition. Its market potential, probable user-acceptance, and enablement aspects have been tested and accumulated using the System Usability Scale (SUS) and securing Intellectual Property Rights (IPR) by receiving patent grants. This paper highlights the developed innovative intervention with its working details. It may act as a ready reckoner and potential literature source for the researchers/ entrepreneurs/ social scientists to develop similar kinds of innovative solutions to equip the lower strata population and the bottom of the pyramid for their betterment and occupational well-being.

Keywords: Online Street Market, Digital Unorganized Sector, Low-cost Cloud Marketing, Design Intervention, Human-centered Design, Occupational Well-being

Multipurpose, Low-Cost and Electricity-Free Cold Storage Cum Vending Cart for Vegetable and Fruit Vendors

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Abstract: The unorganized sector highly contributes to economic growth in India and provides enormous employment opportunities. Street Vendors form an inevitable and prominent part of the unorganized retail sector. Fulfilling the daily needs of almost every Indian household, they are considered the lifeline of every Indian city. In recent years, the organized sector has enormously increased, posing a great challenge to the unorganized sector. Unorganized retail dwelling upon traditional technology setup and constrained funds is not able to compete with superior technology and infrastructure-based organized retail. It severely affects the social structure and occupational well-being of the unorganized retailers, especially the street vendors. There lies a dire need to equip them with technology-enriched low-cost design interventions that may empower them to compete with the organized retail. Several researchers have advocated the need of designing and developing context-specific design interventions as a mitigating solution. In the present research, the authors have looked into the problems and challenges faced by street vendors and proposed a low-cost, multipurpose vending cart to empower the street vendors. It will enable them to compete with their counterparts. Its market potential, probable user-acceptance, and enablement aspects have been tested and accumulated using the System Usability Scale and securing Intellectual Property Rights. This paper highlights the developed innovative intervention with its working details. It may act as a ready reckoner and potential literature source for the researchers, entrepreneurs, social scientists to develop similar kinds of innovative solutions to equip the lower strata population for their betterment and occupational well-being.

Keywords: Product Innovation, Low-cost Design Solution, Bottom of Pyramid, Design Intervention, Human-centered Design, Occupational Well-being

Sustainability a Tool for Employment Opportunities

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Abstract: Environment concerns are on the top priority by the Global policymakers. The environmental concerns are also emphasized by the urban populations of the world, who are struggling for clean and pure air. The urban population with access to the internet is actively participating in the various environmental campaigns on social media but are unable to make any impact on the real ground. On the other hand, the farmers in the rural sector are having seasonal employment, and the remaining part of the year they move to cities for other job opportunities. So we have used the Business model canvas tool to understand the gap and requirement of the current scenario. As per the analysis, we have formulated a business model in which all the available government and forest lands will be used for plantation drive for a greener future. The people from town and cities who are not having land for plantation can use government land for the purpose and at the same time employment opportunities for the rural population for nurturing the plants is also generated. The project is a two-way business model, where the rural population will earn living and the urban population will earn carbon credits (the currency of the future). Apart from monetary benefits, this project will help in spreading awareness for environmental concerns.

Keywords: Sustainability, Business model, Environment conservation rural development

Quantification of Neurosignals for Mathematical Model Development of Muscle Fatigue from Inexperienced Worker

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Abstract: Work Related Musculoskeletal disorders (WMSDs) are the occupational diseases that cause inflammation and degeneration of muscles, bones, tendons or ligaments. WMSDs pose huge challenges to the manual workers and labor oriented industry. This article is primarily focused upon providing relevant results that can eventually be used for the development of mathematical model of the muscle fatigue using Neurosignals. A 32 year old inexperienced worker weighing 65 kg and 5 feet 8 inches tall chosen for this study and electromyography (EMG) signals of his muscles were analyzed for an entire working day (7 hours) for 6 consecutive days. The EMG data was collected from four of the most affected muscles in the industry which were Flexor Digitorum, Extensor Digitorum, Bicep Brachii and Deltoideus Scapularis respectively. The RAW EMG data was further converted into median frequency (MDF) values using suitable filter. Results obtained compared between different muscles and validates previous studies. The observed data evidently shows direct relation between the slopes of MDF lines and successive days. Output of the study can be further used for muscle fatigue quantification and mathematical model development.

Keywords: Musculoskeletal Disorders, Electromyography, Neurosignals, Muscle Fatigue, Median Frequency

Drudgery Estimation in Walking Behind the Power Tiller During Field Operations

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Abstract: To calculate the drudgery involved in walking behind the power tiller, six experience power tiller operators were selected as subjects and calibrated in the laboratory. The heart rate (HR) of the selected subjects was measured during puddling and tilling operations. The HR of fellow person who was just walking behind the power tiller at the same speed and path was also measured to evaluate the effect of hand vibration and noise. The measured HR was used to calculate the oxygen consumption through calibration curve and further Energy Expenditure Rate (EER) was calculated. It was observed that the average HR, volume of oxygen consumed (VO_2) and EER of the operator during puddling were 10.08%, 23.10%, and 10.91% higher than tilling. Further, the average HR of fellow person was 11.26 and 13.15 % lower than operator during puddling and tilling, respectively.

Keywords: Walk behind power tiller, Heart rate, Energy expenditure rate, Volume of oxygen consumed.

Re-design and Ergonomic Assessment of a Handcrafted *Kalash* Polishing Equipment

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Abstract: In India, the handicraft industry is one of the important and export-oriented industries. In this industry, around six million handicraft workers were engaged, and their activities were mostly manual in nature. Polishing activity is one of the most essential activities in handicraft manufacturing. Polishing handcrafted *Kalash* is a traditional activity performed by the polisher of the Hajo brass metal cluster, Assam, India. These polishers perform this traditional activity using conventional polishing equipment in squatting positions for long hours, which requires enormous physical effort. Due to this uncomfortable situation, polishers have exposure to risk factors of work-related musculoskeletal disorders (MSDs). The present study, therefore, interviewed forty polishers regarding MSDs using the Nordic musculoskeletal questionnaire (NMQ). It was revealed that the disorders in the lower back, upper back, and elbows were prevalent among polishers. Further, postural analysis was conducted in Kinovea software. Using existing polishing equipment resulted in postural discomfort. Thus following the focus group discussions with the polishers, the existing polishing equipment was re-designed virtually in CATIA V5 software. Assessment of working posture in both the existing and re-designed equipment was carried out using the rapid upper limb assessment (RULA) tool. The results of RULA analysis showed that the working posture in re-designed polishing equipment was improved noticeably. Therefore, based on these preliminary findings, it is concluded that the ergonomically re-designed polishing equipment in the handcrafted *Kalash* polishing activity could reduce MSDs among polishers and makes the workplace comfortable.

Keywords: handicraft workers, handicraft polishing, ergonomic design, musculoskeletal disorders, posture analysis

Ergonomic Risk Factors Associated with Pineapple Harvesting Task in Northeast India

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Abstract: Manual pineapple harvesting is one of the most critical and challenging tasks in pineapple farming. This study assessed the ergonomic risk factors associated with pineapple harvesting task in northeast India. A total of 152 pineapple farmworkers (92 males and 60 females) were studied using the standard Nordic Questionnaire for musculoskeletal symptoms (MSS) and direct observation. Rapid Entire Body Assessment (REBA) tool was employed to assess the key working postures adopted during the harvesting task for a sub-set of the respondents (12 males and 8 females). The present study found that MSS was highly prevalent (79.61%), and low back (76.32 %) was the most affected body part among the farmworkers. The work postures with high-risk score of 8-10 (action level 3) and very high-risk score 11 or more (action level 4) were 30 % and 70 %, respectively. This study also highlighted a high-risk score of 8-10 (action level 3) for more than 80 % of the participants during the pineapple loading task for local transportation. Farmworkers were exposed to various ergonomic risk factors, which include awkward work postures, repetitive tasks, heavy load carrying, and improper rest-pause might be linked to the prevalence of MSS among the farmworkers. Moreover, walking uphill or downhill on hilly terrain during the harvesting imposed an additional burden on the farmworkers. Based on the results, there is an urgent need to explore effective preventive interventions suited to local conditions for improving the working conditions and occupational wellness of the pineapple farming population in northeast India.

Keywords: MSDs, fruit harvester, posture, load carriage, hilly terrain, discomfort, REBA

Ergonomic Analysis of Manual Activities among Dairy Farm Workers: A Literature Review

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Abstract: Agriculture and dairy farming work involves several work related health issues. The work related health problems are more prominent in developing countries like India. Among these health issues, the most critical are musculoskeletal disorders (MSDs) which are most widespread to an epidemic extent. The research aims to scientifically examine the most significant hazardous factors causing MSDs and propose the possible ergonomic solutions. The literature was searched from different databases using different search criteria.. The review was restricted to physical health issues among dairy farm workers developed due to heavy load and repetitive tasks in awkward posture.

Literature reveal that MSDs creates more prolonged effect on the workforce of developing countries compared to developed counties because of the acquaintance to mechanized dairy operations in developed countries. Dairy farming includes different manual and repetitive activities like milking, feeding cattle, manure cleaning and medical operations. Continuous repetitive activities in uncomfortable postures such as bending, kneeling as well as the use of inappropriate tool design results in the emergence of different MSDs including lower back problems. Prevalence of MSDs and lower back problems was found to be significant which needs a proper ergonomic intervention. The safety and health measures in agriculture and dairy farming business need a global reformulation to enhance awareness on injuries arising and chronic MSDs.
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Keywords: Dairy Farming; musculoskeletal disorders; manual material handling, ergonomic intervention.

Optimal Design of Customized Ankle Foot Orthosis for Drop Foot Patients

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Abstract: Orthotics and prosthetics are components used to support weakened part of the body or muscles which are unable to do its intended function. While earlier one enhances limb ability, later one completely replaces the limb. Starting from Mesopotamian civilization till now, Ankle Foot Orthosis (AFO) had undergoes transition in design development from passive to active AFO and in fabrication process from conventional casting process to Additive Manufacturing (AM) but certain gaps remain unfilled to have an optimality in strength and stiffness. This article comprehensively discusses about "Customization of AFO" fabricated from AM for Drop Foot (DF) patient eccentric requirements in gait stability and energy absorption. Additionally, the scope for low-cost host material and their efficacy on compensatory mechanism for appropriate Gait is provided.

Keywords: Customized Ankle Foot Orthosis, Additive Manufacturing, Optimal design, Drop Foot.

Learning Indian Classical Dance Forms with the Help of Augmented Reality (AR) Application

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Abstract: Indian Classical Dance forms have always been classy and a very hard dance form to learn and understand. A small research was done to understand as to how young dancers, learners think about the collaboration learning of classical dance. Most of the students and learners are not being guided properly in most random dance learning institutes. Indian Classical Dances have dynamic moves and positions that are often not understood by many learners and dancers even after attending physical workshops as the trainers and instructors are not very interested in demonstrating it again and again for students. A solution has also been proposed to the problem of young dancers and learners across the world face while trying to learn or reach out trainers or experts. To maintain the beauty and divinity of the dance styles, a novel AR based classical dance app has been ideated. This technology-based solution has made possible a lot of things such as making culture, tradition famous and known. If people used this solution wisely, it can promote as beautiful and dynamic as classical dances on a global platform and also help in reaching the dance forms in reaching greater heights.

Keywords: Augmented Reality, Dance, Learning, Usability, User Experience

Application of Immersive Media to Develop Model Making Skills of Industrial Design Learners

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Abstract: Unprecedented challenges during the COVID-19 pandemic led to the educational institutes close with uncertainty around the world. To continue the academic year most educational institutions have shifted to online educational platforms. Design institutes in India too adopted online classes using various online network platforms. Immersive media, such as Virtual Reality and Augmented Reality (VR and AR) has recently gained prominence in design education. Many researchers have highlighted that the VR/ AR could help students improve their performance and conceptual understanding of a specific set of learning objectives. This study has helped them to identify the most common difficulty faced during online courses like model making course. VR and AR based instruction setup that allows the collaborative discussions between faculty and students are remotely discussed. The brainstorming process was used to generate ideas for improving the learning experience in the dexterity skill-based model making course through the use of immersive media. Heuristics analysis was also conducted to ensure the usability of the AR and VR based instructional interfaces. It was observed that the interactive AR based immersive instructions are better than the VR based instructions. This study can be continued further with design students to determine how effective it is to use visual clues in a model-making course using Immersive media.

Keywords: AR, Immersive Media, Immersive Technology, Industrial Design, Instructional strategy, VR

Evaluation of Comprehensibility of a Sign by Triangulation Method

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Abstract: Comprehensibility is the most crucial factor for the design and evaluation of a sign. Evaluation of sign's comprehensibility through appropriate method is of utmost necessity before its implementation to avoid the wrong interpretation and thereby devastating impact. Hence, a comprehensibility evaluation of a sign was attempted using the triangulation method to overcome intrinsic biases from a single method study. One important COVID-19 warning sign was shown to 50 volunteers (43 male 7 females, graduates, and non-OSH experts) who were employees of India's leading manufacturing organization. Two different methods were used for the comprehensibility assessment of the given sign. One was in the form of a score, and the other was in the form of a short descriptive answer. Two OHS experts evaluated both types of responses. The threshold was tuned between 30% and 100%, and comprehensibility results were recorded accordingly. The given sign was found comprehensible to 40% of the volunteers in Method-1 and 48% in Method -2 when comprehensibility was judged based on the gold standard, i.e., 60% (score = 0.6). The findings of both methods were found to be almost similar and effective in evaluating comprehensibility. The triangulation using two different methods produced consistent findings and revealed high positive correlation of data between two methods (Pearson r = 0.86). Both collected data and methods were thus validated and qualified for the generalization of the observed result. Hence, researchers became confident about the results of the sign's comprehensibility, although the sign was found less comprehensible, needing further research and redesign.

Keywords: Semiotic, Sign, OSH, Sign Design, Design Research, Cognition

Design for Cognitive Development of Kids: A Case Study of Developing Interactive Toy for Small Children

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Abstract: Toys play an important role in kids cognitive and physical development. Before starting the formal education with alphabets and numbers, the kids learn and understand different phenomena around them by experiencing things through their senses. They learn about different natural objects, creatures and phenomena by touching them or perceiving them through their other senses i.e. through seeing, smelling, hearing or tasting. In this cognitive journey of learning new things, the toys play a vital role. They try to imitate the real creatures and provide the related information in an effective way much before they actually come across those entities. Designing such toys in itself is an insightful experience. The paper discusses the process of developing one such toy i.e. Crocodile toy. and details the process of how different features of the real creature have been integrated to deliver important information about it in an interactive way. The paper concludes with discussion on tentative strategies to evaluate the efficacy of the toy.

Keywords: Toy, children, Cognitive development, Design, Alligator- like toy, Ergonomics perspective, Features.

Development of Scale for Assessing Occupational Health Hazards in Post-Harvest Activities (OHHPA Scale)

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Abstract: Agriculture is oldest and most important primary occupation compared to other occupations. In Assam, more than 70 per cent of farm women are involved in post harvest activities such as threshing, sun-drying, sieving, winnowing, cleaning, seed selection and storage of grains. Post harvest activities are performed by utilizing manual labour and farm women are exposed to variety of health hazards. An attempt was undertaken to develop a scale for assessing occupational health hazards in post harvest activities (OHHPA scale). Survey method was conducted on three hundred farm women of six different villages of Jorhat district, Assam. Women samples were selected at three stages viz – 60 respondents for item analysis and testing reliability and 300 women samples for administering the developed scale. Personal and demographic characteristics of the respondents revealed that hundred per cent were literate and two third of the respondents belonged to nuclear families. Eighty two per cent of the respondents were marginal farmers who have 1 acre of land for paddy cultivation. Majority of the respondents (88 %) were in the age group of 30-40 years. Biological, physical, accidental and environmental hazards were common among Assamese farm women except chemical hazards. Respondents in the 'high' incidences category was found to be more than 38 per cent who were suffering from all types of hazards where as 'severe' incidences category were nil in the study area. The findings also showed that 58 per cent respondents were in the category of 'high' incidence of hazards in post harvest activities.

Keywords: Agriculture, Occupation, Health Hazards, Post Harvest Activity, proneness

Heuristics of Smartphones and Tablets to Identify Human Factors for Improving User Experience

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Abstract: Internet of Things, refers to products and gadgets around the globe that are now linked to the internet and automation, gathering and sharing data for improvement of lifestyle by innovation and automation. Early involvement of human factors professional(s) and iteration are the keys to successful smart device development. Human Computer interaction issues such as information presentation, usability, error tolerance. Smartphones and Tablets have become more commonplace, the user experience becomes increasingly important. NASA Task Load Index method to identify user performance metrics, Questionnaire for User Interface Satisfaction (QUIS), Subjective Workload Assessment Technique (SWAT) to identify and measure user time duration while using gadgets, cognitive effort load and stress and tension load to find better solutions. The research article will provide relevant human-centered strategies and Design Thinking solutions to designers, engineers and innovators to build and design smart Internet of Things products with better User Experience Interaction based on User Research, their physical needs and cognitive comfort.

Keywords: NASA Task Load Index, Subjective Workload Assessment Technique, Smartphones, Tablets, Usability and User Experience, Human Factors.

A Questionnaire Analysis for Customizing Bicycle Design Based on Musculoskeletal Disorder Discomfort Level

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Abstract: Cycling, which was once used solely for transport purposes in past decades is now being major-ly used for recreation, exercise, and as a sport. Cycling improves cardiovascular fitness by reducing body fat levels. In recreational aspects, there are organized rides, cyclo-tourism (which involves exploration by bicycle), Mountain Biking (known to be Downhill mountain biking). To have considered it as a sport, cycle racing is common for almost a century all across the world. In this study, we have analysed musculoskele-tal disorder (MSD) for different genders of bicycle riders, along with the different types of bicycle design for the users in the southern region of India. Methods: 129 Indian participants (89 males and 40 females) of various ages were considered. A questionnaire was created and surveyed among the participants regarding the areas of pain during cycling (based on the RGB pain score of 0 to 5) for different types of bicycle de-signs. Results: Based on the statistical analysis with the acquired data, it is found that females suffer pain more than males notably in the region of thighs and knee. Analysis about the effects on the participants based on the different cycle designs such as Gearless, Geared, Rigid frame, Single suspension, Mountain bike used was also performed. As a result, single suspension bicycle users exhibited high pain scores. These results indicate that appropriate ergonomics issues are to be considered to develop a better bicycle design.

Keywords: Bicycle design, Ride comfort, Musculoskeletal disorders (MSDs), RBG pain score, Question-naire.

Exploring Aesthetics of Vaastu Shastra: Transformation of Domestic Architectural Spaces

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Abstract: Vaastu Shastra is considered an Ancient science that stemmed from the way of life aligned with nature. Design that connects with man, nature, and its science deals with a more systematic and user-friendly interface, the resultant space ensures user well-being within the guidelines stipulated by Vaastu Principles. To a particular extent, principles of vaastu shastra lead the design process, which tries to extend its application throughout the evolution and transformation of the built environment. The aesthetics of the built environment, as per Vaastu Shastra are maintaining its historical trajectory and preserving its design sense in continuity. Nevertheless, domestic architectural spaces are susceptible to changes over time-based on design requirements and advancements in construction techniques. Thus the connection between a User oriented space and the environment connect seems to be missing. The relationship between the environ-ment and human interactions fetch an extra value to traditional architecture. The fundamental pramanas (principles) of Indian vaastu ensure the quality of both life and built environment in any dynamic circum-stances. The current study evaluates the environmental aesthetics of traditional domestic architecture through principles of vaastu and usability heuristics by exploring 2 different architectural case studies from pre-independence and modern times.

Keywords: Vaastu shastra, Principles of vaastu shastra, Traditional architecture, Domestic architecture, Environmental aesthetics, Usability heuristic.

Combined Use of Selected UX Research Techniques and Creation of User Persona for Design and Evaluation of Sustainable E-Commerce Apps – A Case Study

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Abstract: The advent of digital economy, the expansion of Internet user base, the surge in the number of smartphone users, and the increasing interconnectedness of man, machines and organizations have fuelled a phenomenal growth in the market penetration of e-commerce worldwide. The disruption of physical shopping by COVID-19 outbreak and the consequent change in consumer behaviour, leaning more towards online shopping, has also significantly pushed up that growth trajectory. The proliferation of e-commerce-apps is a complementary component of this phenomenon, and the competition for sustainability and growth of these apps and the associated companies is ever-increasing. The above developments have necessitated the according of heightened attention to User Experience, i.e., UX, and cognitive response, manifested in consumers' need, preference, attitude, behaviour and comfort, in designing new e-commerce apps and continually improving the existing ones. For meeting this need, a plethora of tools and techniques are available for informing the design process from the perspectives of end-users for enhancing user-centric design efficacy and productivity of the apps. In this paper, a methodology of combining six UX research techniques has been deployed and a user persona has been created in a novel framework by selecting an existing e-commerce App and engaging a consumer newly opting for online shopping. Pain points have been explored and scopes of improving the App identified. This methodology of bettering usability and user experience would be useful for the design and testing of not only e-commerce apps but also of apps developed for numerous other fields of applications.

Keywords: UX research, e-commerce App, online shopping, user persona, sustainability, design efficacy

Understanding the Experiential, Experimental and Spirited Aspects of Typography

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Abstract: Using sign and symbols as a mode of communication is a very old tradition. Our ancestors have used it efficiently to communicate and share thoughts between each other. In the later period, along with the evolution, different tools and techniques also developed to support and enhance the communication process. Use of type or letters was one such development in the history. This helped to translate language into a written form which can be preserved and share with wider audience. Across the timeline, designers and researchers have experimented with the different attributes of letterforms to communicate effectively. Through literature review and classroom case study, this paper has aimed to explore different approaches which can be used to make typography more experiential and spirited in the classroom setup as well as design projects.

Keywords: Experimental typography, Environmental typography, Type as a product, Type & Space, Playful learning, Practice Based Research.

Comparison of the Hip and Trunk Muscles Activation Between Cyclists with and Without Low Back Pain

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Abstract: NSLBP is the prevalent stumbling block for cyclists but still, studies investigating the cause of NSLBP and its association with abnormal lumbothoracic kinematics are scarce. The study aims to examine the difference in co-contraction of the hip, lower lumbar, and thorax muscles during the ride in cyclists having non-specific low back pain (NSLBP) and their normal counterparts with increasing time. A total of twenty-five cyclists participated in this study. Thirteen cyclists had NSLBP and they were differentiated from their 12 healthy without pain counterparts after assessment for low back pain. They were to ride their bicycle on a training roller for 30 minutes or till the back pain starts. Muscles kinematics was measured with the NORAXON^{TM} USA monitoring system. Pain scale ratings were taken throughout the riding. Repeated measures ANOVA revealed a significant effect for the NSLBP group for thoracic erector spinae (TES) and multifidus (MF) $F(1) = 7.003$, $p \leq 0.024$and $F(1) = 24.23$, $p \leq 0.001$ muscles respectively. The decrease in the mean amplitude of MF, TES could be due to impaired flexion relaxation response of putting strain on spinal structures leading to pain and non-pain group showing an increasing trend for the same variable may be due to strong compensatory mechanisms of fundamental stabilizers which co-contract with increased strength when muscles controlling movement previously start fatiguing. This study suggests that the NSLBP group shows a motor control pattern disturbance leading to decreased co-contraction of TES and MF may give pain.

Keywords: Electromyography, Cyclists, Low Back Pain, Multifidus, Erector Spinae

Subject Matter Experts versus OSH Practitioners: Criteria Selection for the Assessment of Pushing and Pulling of Wheeled Equipment in the Workplace

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Abstract: The current study aimed to determine the critical variables for the assessment of pushing and pulling (PP) of wheeled equipment based on the survey conducted among occupational safety and health (OSH) practitioners and subject matter experts (SMEs). An online survey among OSH practitioners and SMEs from the respective industries was undertaken to gain further insight into some of the issues. The online survey selection was based on the mode value as it is more significant compared to the median value for each variable. The variables in the SMEs were chosen based on the validity ratio above 0.59. The number of SMEs provided was 11. Out of the 23 variables in assessing the PP activities, 11 (47.8%) variables (handle height, handgrip, load magnitude, frequency, distance, presence of co-workers, posture, task duration, floor conditions, congestion in the workplace, and the age of workers) turned out to be essential from the OSH practitioners survey. The SMEs' reviews resulted in 13 (56.5%) variables (type of device, wheel diameter, handle height, handgrip, load magnitude, frequency, distance, posture, task duration, floor condition, obstacles along route, congestion and gender). It is interesting to observe that most of the variables were not considered in the currently available risk assessment tool targeting PP. Therefore, it is reasonable to develop a new assessment tool for PP activities by considering the input from the OSH practitioners and SMEs.

Keywords: Pushing and pulling, subject matter experts, OSH practitioner, ergonomics, observational-based risk assessment, wheeled equipment

Effect of A Six Week App Based Ankle Proprioception Training Program on Balance in Fencers

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Abstract: To achieve peak performance while avoiding lower-limb injuries, superior balance is a prerequisite, in most sports including fencing. Because the ankle-foot complex is the only region of the body that is in contact with the ground during most sports related movements, ankle proprioception is perhaps one of the most vital components in maintaining balance in sports activities. Fencing is an open-skilled combat sport based on complex footwork which demands strength, flexibility, and stability of the lower limbs. App-based rehabilitation programs leverage on video games' intrinsic motivational potential by allowing players to operate a game through the use of a wobble board while performing prescribed exercises. Therefore, the goal of this study was to evaluate how a six-week balance and proprioception training program using a smartphone app impacted fencers. Ten university level fencers of Guru Nanak Dev University between the ages 18-23 years volunteered to participate in the study. A smartphone app (Classic Labyrinth 3D Maze - The Wooden Puzzle Game, Developer - Cabbie Games, Version: 7.7) and a wobble board were used to train balance and proprioception for six weeks. Kinematic Measurement System (KMS) and lower quarter Y balance test were used to measure balance before and after the intervention. A significant increase in the absolute and relative reaches in all three directions of the Y balance test and a reduction in the contact times in KMS was observed following the intervention. This training program is effective for improving balance in fencers.

Keywords: Balance, Fencing, Interactive Rehabilitation, Smart Phone Application, Proprioception.

The Need of a Digital Typeface for Assamese Script

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Abstract: India is a land of vast diversity, a home to hundreds of communities and languages. In the northeast of India lies Assam. Even with the existence of multiple tribes and languages in Assam, Assamese is considered as the official language with more than 15 million speakers and serves as lingua franca of the region. Though there are differences in spoken medium, the script for Assamese language is very similar to that of Bengali script, historically there were certain differences in the former scripts but the ones which are being used now are the same except the character 'ৰ' (ra) and 'ৱ' (wa), which is missing in Bengali script. However, there are not a lot of Assamese Unicode typefaces available on the internet. Even among the available ones most of them have been designed for print mediums like newspapers or magazines. This paper is aimed to understand different guidelines important for designing a digital typeface by reviewing existing literature and to design a new Assamese typeface suitable for screen-based applications.

Keywords: Indic typeface, legibility, type design, Assamese font

Musculoskeletal Pain Experienced by The Marble Cutting Workers in Marble Industries at Kishangarh District, Rajasthan

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Abstract: Musculoskeletal pain refers to pain in the muscles, bones, ligaments, tendons, and nerves may be in one area of the body or throughout the body. Musculoskeletal disorders (MSDs) and pain are the ma-jor causes for workers' inability, expense raise, and efficiency reduction in industries. A large number of persons are engaged marble based industries. Despite of the technological development for lifting bulky marbles and cutting them, the role of a human being cannot be denied. The present study was undertaken, to gain an insight regarding the musculoskeletal pain experienced by the Marble Cutting workers involved in cutting Marble slabs into small tiles at the Marble Industry with an experience of minimum 2 years. A questionnaire was developed to collect data on the pain experienced by the respondents since the past 12 months and last 7 days in their body parts while doing the various movements with each body part, resting and by carrying out the activity as reported by them. The mean age of the respondents was 36.77 years. The mean years of working experience in the present marble industry was 5.66 years. On calculating the weighted mean for perceived musculoskeletal pain for each body part of the respondents for past 12 months, it was revealed that back was ranked highest followed by palms and shoulder. The findings of the study will aid Marble Association of Kishangarh and the Workers to gain an understanding regarding the issues faced by the workers and thus aiding in regulations for the same.

Keywords. Musculoskeletal Pain, Marble, Marble Cutting workers, Marble Industry

Incidences of MSDs Prevalent Among Indigenous Women Involved in Petty Trading in Assam

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Abstract: Petty trading is a women dominated occupation of some indigenous people for income supplementation of family by selling home grown and naturally grown organic vegetables, herbs, rice, pulses etc. They sit daily to sell their products in market place for more than six hours/day round the year assuming continuous awkward posture. It is an important ergonomic aspect to focus at to understand the prevalent risk factors faced by women in this occupation. Majority of them complained of pain in both lower and upper back and was ranked I and II respectively, knees, neck and ankles were in IIIrd, IVth and Vth ranks. Some complained of numbness in lower limbs, frozen shoulders and many more. Positive correlation was found between age and level of musculoskeletal disorders among the respondents. Performance of different activities like carrying goods with head and back support in bamboo baskets, sitting in very low height or in squatting posture continuously with upper limb movement for lifting and reaching products was analysed through OWAS that revealed high value action categories which were indicative of "work postures with distinctly/extremely harmful effect on musculoskeletal system requiring immediate solution in working methods. The flexi scale measurement revealed a deviation of posture in upper and lower back from the normal walking and sitting.

Keywords: Indigenous women, Squatting posture, Musculoskeletal disorders, Risk factors, Awkward posture

Evaluating Indoor and Outdoor Thermal Comfort Parameters Affecting Work Environment of Railway Pantry Car

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Abstract: Indian Railways is one of the largest passenger transport networks in the “world” covering almost all parts of the subcontinent. Pantry car is an integral part of the railway, which provides food to the passengers during the journey. This study aims to evaluate the “indoor and outdoor thermal comfort parameters” and working conditions in the kitchen of the Indian “railway pantry car”. The field measurement was carried out during the summer season on six “Indian Railway Pantry Car Coaches (IRPCs)”. The “indoor and outdoor environmental parameters” were recorded during different cooking periods; "breakfast, lunch, snacks, and dinner" inside the pantry car. The consequence of this study revealed that the “indoor thermal comfort parameters” like; "wet-bulb temperature, mean radiant temperature, air temperature, relative humidity" were higher as compared to outdoor parameters except for air velocity. Most of the time, indoor parameters were higher during the lunch and snacks periods while lower at the breakfast period. Similarly, indoor Heat Index (HI) value was recorded higher than the outdoor. The indoor HI values range were found to be (40°C-58°C), which indicated "danger to extreme danger" work condition. These outcomes will help to understand the “working environment of the railway pantry car kitchen”. Further, data measurements during winter and other seasons could be used to predict the thermal environment of the “pantry car”.

Keywords: Environmental ergonomics, Thermal comfort, Railway, Pantry car.

Musculoskeletal Discomfort faced by Interior Design Students during Online Learning

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Abstract: Musculoskeletal disorders are prevalent in young adults in the present times. A major section of this age group are the students pursuing higher education. In the current pandemic situation due to COVID-19, the students have been forced into attending classes through online mode and so the infrastructure available at home may not be optimal ergonomically, leading to musculoskeletal discomfort amongst the students. In Interior Design course, the students are required to do practical work in a sitting position using the furniture available at home. They are also required to attend classes through computers, tablets and smartphones, which can also lead to musculoskeletal discomfort. As these students are exposed to the risk of developing musculoskeletal disorders, the present study was conducted with objectives (a) to gain insight into working methods and home workspace of the students, (b) to identify incidence of musculoskeletal discomfort experienced by interior design students during online learning and (c) to find out the perceived causes of musculoskeletal discomfort by the students. The sample of the study was 77 undergraduate students pursuing Interior Design course and data was collected using questionnaire. The findings of the study revealed that these students are in need of proper workspace and work environment at home, they need guidance in optimizing there working methods and developing proper work schedules and lastly, they need awareness regarding maintaining correct postures during sit-down work as well as corrective measures for optimizing their current work-station at home.

Keywords: Work-Station at Home, Optimal Workspace, Perceived Causes of Musculoskeletal Discomfort, Musculoskeletal Discomfort, Online Learning, COVID-19 Pandemic.

Prevalence of Musculoskeletal Discomfort among Banking Employees in Assam, India

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Abstract: Banking sector act as spine for nation's economy. Rapid changes in technology and computerization process in the banking sector might not affect only employees but also their working environment. Poor work station design, continuous use of computer for the entire workday, prolong sitting, awkward posture and long periods of static work may affect the health of bank employees and predispose them to musculoskeletal problems. Objective: To identify the musculoskeletal discomforts experienced by the employees working in three district of Assam namely Gu-wahati, Jorhat and Sivasagar. The selected sampling technique was purposive convenience sampling. Online questionnaire was used as a tool for data collection which had two sections. The first section com-prised of background information of the employees and the second section covered Standardized Nordic Musculoskeletal Disorder Questionnaire (NMQ), 1987. The findings revealed that mean age of the respondents was 32.88 years. More than two-third of the respondents were males having 1 to 12 years of service in banking sector. Majority of the respondents per-ceived discomfort in their neck(64.42 per cent), right shoulders(44.23 per cent) & upper back (52.88 per cent) during last 12 months. It was also unveiled that discomfort in right wrist was perceived by 44.23 per cent of the respondents during last 12 months. The findings of the study will be helpful for the banking sector and designing the workplace as per the employees for better productivity and efficiency.

Keywords: Musculoskeletal Disorders, Banking Employees, Assam

Fatigue Analysis of Recreational Road Cyclist in Terms of Blood Lactate Concentration and Nutritional Intake

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Abstract: Blood lactate concentration is one of the most often measured parameters during performance testing of athletes. The purpose of the study was to measure the serial change in the rate of blood lactate concentration in response to the sequential period of cycling. Seven male road cyclists volunteered to be subject in the study. Subjects participated in a 200 km cycling event. Their anthropometric measurement, nutritional intake (three consecutive days), and blood lactate concentration was measured. Their mean age was 38.6±8.7 years, body height 170.9±4.6 cm; body weight was 74.1±7.2 kg with 25.4±2.1 (kg/m^2) BMI and 24.9±3.2% fat percentage. The subject's blood sample was measured through finger-stick (capillary) blood sampling by using an automated blood lactate analyzer. Lactate measurement was made four times: at rest, immediately after the event, 5 minutes, and 20 minutes of passive recovery. The study has shown that participants resting LA (2.2±0.9 $mmol.L^{-1}$) was fall into normal range whereas with the passive recovery there was a gradual increase in their blood lactate concentration (5.6±2.9 to 9±3.5 $mmol.L^{-1}$) up to 20 minutes of recovery time. The mean energy intake day before the event and during the event was less than recommended level by ICMR. Hence it can be concluded that less nutritional intake during and before cycling event might be the cause of less energy production and depletion of muscle glucose which might lead to more lactate accumulation in the muscles during the recovery period.

Keywords: lactate concentration, nutrition intake, passive recovery

Incidence of Forward Head and Rounded Shoulder Posture in Sports Involving Overhead Activities Among University Athletes

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Abrtract: A great deal of stresses are placed on the shoulder complex while performing overhead activities in sports that involve actions like throwing or hitting a ball because of repeated force generation, asymmetry in the loads or use of limbs. The development of postural defects like the forward head posture (FHP) and round shoulder posture (RSP) make the athletes more susceptible to shoulder injuries. To assess FHP, RSP and shoulder pain and disability index (SPADI) in players presenting with shoulder pain.75 participants aged between 18 to 25 years, playing sports involving overhead activities and had a complaint of shoulder pain were included in this cross-sectional study. FHP and RSP was evaluated using photogrammetry method (autoCAD software). The shoulder pain and disability was assessed through a questionnaire (SPADI). The percentage of players presenting with FHP and RSP was 38.67% and 53.33% respectively. Mann- Whitney U test was applied on the SPADI score of the participants having FHP/RSP and not having FHP/RSP. Significant difference was only seen in the mean rank of total score of the players of “having FHP” and “not having FHP” whereas no significant difference was found in RSP group. It can be recommended that the players having FHP and RSP should undergo a posture correction program to prevent any kind of shoulder injury. The findings of present study can provide a guide to coaches and physiotherapists for better assessment of a painful shoulder which can also prevent recurrence of injury.

Keywords: Forward head, Rounded shoulder, Posture, Shoulder pain, Overhead sports, Disability

An Ergonomic Study on Prevalence of Work-related Musculoskeletal Discomfort among Information Technology (IT) Professionals Working from Home in COVID-19 Pandemic

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Abstract: COVID-19 Pandemic made working from home a necessity for IT professionals and computer users. Prolong working hours in confined or awkward posture leads to musculoskeletal injuries. The aim of the present study was to assess the prevalence of work-related Musculoskeletal disorders (MSDS) and ergonomic limitations of computer users from IT background working from home due to the COVID-19 Pandemic. Eighteen subjects from IT Industry between 25-35 years were randomly selected for this study. A Workstation checklist and a Modified Nordic Questionnaire was used to assess the present workplace at home and prevalence of discomfort or pain. The postural analysis was performed using the standardised protocol of Rapid upper limb assessment (RULA). The study indicated that IT professionals working from home had an increased likelihood of developing work-related musculoskeletal injury primarily in neck, Shoulder, wrist, elbow and lower back. About 49% of the subjects were respondent to discomfort or pain. 28% of the subject felt moderate low back pain and 44% experienced mild low back pain, 50% were having neck discomfort and 44% underwent both. RULA scores of IT professionals indicated the risk of development of musculoskeletal injury. IT was also revealed that 65% of the subjects were unaware of work ergonomics and 17% of subjects followed work ergonomics. It may be concluded that lower back discomfort and pain in upper extremities are the major health issues, occurred prevalently among the IT professional during working from home without an ergonomic workplace during COVID 19.

Keywords: IT professional, Ergonomics, MSDS, work from home, COVID 19

Impact of Work-Related Factors on Musculoskeletal Discomfort Among the Rural House-wives in Central India

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Abstract: Domestic work has various risk factors and hazards like the other working sector. Studies show women are more likely to MSDs than men as they are consistently found to spend more time at work. The present study aimed to evaluate the prevalence of musculoskeletal discomfort and its associations with work-related factors among the rural housewives in Chhattisgarh, India. The present study was conducted on 500 housewives from selected villages of Raipur district of Chhattisgarh, India. Subjects were selected by random sampling for data collection. Assessment of prevalence of MSDs was done by Standardized Musculoskeletal Discomfort Questionnaire and evaluation of work characteristics by ergonomics checklist. Analysis of body posture by REBA was done to assess the Level of MSD Risk for the postures adopted by the housewives during their daily working activity. Out of 500 housewives, 303 (60.6%) women had musculoskeletal disorders. Out of 303 affected housewives, 39.27% had pain in the hip region, 37.95% were suffering from lower back pain and 19.47% had pain in both the knees. Individual factors such as age, BMI, and the number of pregnancies were found a significant association ($p<0.05$) with occurrences for musculoskeletal pain in various regions. A Significant association ($p<0.05$) was found with Musculoskeletal Discomforts and various work-related factors (work type, posture, load, duration, temperature). This study confirmed the associations of work work-related factors with musculoskeletal discomfort; therefore, a preventive measure at the workplace should be directed to the housewives for the improvement of the work environment, safety awareness, and workload optimization.

Keywords: Musculoskeletal discomfort, Work-related factors, housewives, lower back pain.

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Assistive Devices Applicable for Inclusive Design in Higher Educational Institutes in India: A Systematic Review

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Abstract: According to WHO, 15% of the world population has a disability. Achieving universal education for everyone and creating inclusive infrastructure is a part of the Sustainable Development Goal for 2030. Considering the feasibility of implementing the design and technological interventions for developing inclusive infrastructural facilities in higher educational institutes (HEIs), the current review focuses on HEIs in India. In developed countries, relevant research work is in full swing, and thus, design and technological intervention are being implemented in their HEIs. In developing countries, research has been rarely reported in this context. Moreover, data on assistive devices and human factor issues for making the HEIs universally accessible are seldom available. Hence, the present research aims to study existing assistive devices that HEIs could adopt for inclusive design for making Persons with Disabilities (PwDs) an integral part of the system. The literature search was conducted using Scopus and Web of Science databases to shortlist papers using suitable keywords and combinations while following the PRISMA framework. The collected literature was segregated under types of disabilities, difficulties faced by PwDs in HEIs, assistive devices for various limitations, application of assistive devices in the domain of services associated with education in HEIs. Further, primary research on the status of inclusive design should be taken forward, as there is a gap in research on the state of the art of inclusivity in HEI in India. Reported research would serve as the database on assistive devices for researchers working in the field of inclusivity, with particular emphasis on HEIs.

Keywords: Specially-abled, Teaching and Learning, Campus Space, Person with Disability, Architecture, Assistive Technology

User and Market Research with Proposed Concepts for Ceiling-Fan Dust Cleaning

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Abstract: Ceiling-fan cleaning tools/equipment are necessary household items in India. Considering the present market, very few cleaning tools (products) are available for the ceiling fan's dust removal process. These products weren't successful among the users due to several ergonomic and usability issues. However, there isn't any research article regarding this information/ fact. Therefore, this paper aims to obtain information regarding the user's experience with existing ceiling-fan cleaning tools/equipment and propose few new designs for addressing the user's problems. Initially, market research has been conducted to understand the needs/expectations of the users regarding cleaning methods and existing equipment. A user survey was performed using a questionnaire, which helped in further insight into the design process. This survey includes several questions regarding the aforesaid issues during the ceiling-fan cleaning task. Using the brainstorming technique, various concepts have been generated. The cleaning tool's new conceptual designs were developed to address the user needs (functional and aesthetical) and expectations. From the result, it's been observed that the user felt some pain/ discomfort in certain body regions like the neck, shoulder, and arm, as well as a major strain on the lumbar area. The other major concerns were also observed such as reachability, ease of usage, and ease of implementation (interactions with the product) while using the existing ceiling-fan cleaning tools/equipment. Considering these user's concerns, few concept designs were proposed, which are expected to be a better design for the ceiling-fan dust removal process.

Keywords: Design, SCAMPER, Market Research, Online survey, Job screen.

A Peer-To-Peer Teaching Model for Enhancing the Accessibility to And Quality of Education of India

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Abstract: The education system of a nation is a crucial deciding factor of its growth through human resource development, empowerment, and productivity. Yet, one of the many problems it faces is concerning a large group of students under the care of Non-Governmental Organisations (NGOs) which generally remains deprived of quality education. Although NGOs project their objectives highlighting their focus on education and growth of children under their care, a considerable difference between their words and works is often found to have a limiting impact on the attainment of quality education. In this paper, a service design is proposed with the objective of connecting the children under the care of NGOs to students of schools of the Mainstream Education System (MES) in a peer-to-peer teaching model for effective exchange of knowledge and resources towards enhancing quality education. The realisation that humans are social creatures who depend on community interaction for most of their activities is one of the pillars of our proposed model in an attempt to focus on the importance of the "human side" of the service which enables an equal flow of benefits and opportunities amongst all stakeholders. This model seeks to incentivize the students of schools of the MES to voluntarily take part in this system which would assign credit points for successful completion of the service. It is emphasized that, besides directly contributing to the enhancement of education, this model would also help students develop soft skills and provide service to society, thereby making this model attractive.

Keywords: Education, human factors, peer to peer, schooling, learning model.

Gauging Global Green Governance of the Millennium: The Roadway Towards Human Progression

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Abstract: Amidst waves of rapid changing digitalized global hemisphere environmental conservation is the call of the hour. Today it is quite pertinent to reframe the environmental sustainability agenda merged with global life support system for meaningful human survival. The new millennium of green revolution gives a futuristic look and recognized as a universal parcel of environmental protection worldwide. In this paper the essential objective is to reinvent the prime domains and items in tune with effective environmental restoration and proposing a conceptual framework for building global green governance. The research work is qualitative in nature based on primary and secondary data. The primary was collected by detailed survey questionnaire and the secondary data was collected from various books, journals, reports, newspaper and relevant websites. The five broad domains identified are Innovative Green Practices, Building Effective Environmental Management Tools, Upholding Environmental Ethics, Climate Change Proponents and Global Climate Governance using literature review as essential basis. A conceptual global environmental framework has been formulated study which can be used as a standing tool considering the novelty of the study in similar research work. The relevance of environmental restoration amidst present turmoil is of utmost concern in the present day global habitat. The study upholds that the right to healthy environment is not only the right of the present generation but indeed the very root of human progression on earth.

Keywords: Environment, green, global, human, governance

The Ergonomics of Play: Recalibrating 'Play Spaces' of Thiruvananthapuram Government Primary Schools Toward Multiplicity

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Abstract: The act of play is ambiguous, temporal, transcendental and transformative. To play, is to position oneself relative to the other, suggesting a notion of power or even challenging it. To play, is to be - to identify oneself or to even imagine oneself as multiple beings behind the mask of the body. To make space for play and to design for it is often met with basic design guidelines irrespective of the different ergonomic requirements of various users, gender, ability, location, socio-cultural context, or space availability. This leads to the act of play being regulated, controlled and often restrictive for children in the process. The paper, therefore, intends to investigate existing play space design as constructs of inherent hegemonic sociocultural systems of the school as an institution by mapping activity patterns of children in four lower primary government schools of Thiruvananthapuram that encapsulate following parameters: designated play area, (non)presence of play equipment and the physical components of play spaces. Opening an enquiry regarding 'what makes architecture playful', the paper offers design considerations through formal and spatial analytical parameters of space to think about autonomy, safety, and inclusivity through multiplicity in play space design to allow for space to be created through the act of play, rather than demanding for specified engagement.

Keywords: play space design, government primary schools, ergonomics, play equipment, children, playful spaces

Fishbone Diagram Analysis for Assessing Ergonomic Risks in Onshore Oil Rig Operations

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Abstract: Oil producers are always keen on ensuring safety standards followed in oil rigs and adheres to it during crude oil extraction. Global economy still relies heavily on petroleum production even though renewable energy sources are playing a vital role. Onshore oil rigs are used to extract crude oil from underneath the earth surface. As the working environment is more challenging and riskier in operations, ergonomic interventions are accepted by most of the companies. Despite the safety culture and large-scale modernization, still the industry shows high ergonomic risks and leads to musculoskeletal disorders to workers. Fishbone diagram analysis is a graphical tool used by many organizations for making diagnoses or taking concrete actions in which, the root cause of the problem is identified. The present study analyses the ergonomic risks associated with onshore oil rigs using fishbone diagram analysis and assess the risk factors based on machine, method, materials, measurement, man and environment. In- addition, the study presents the ergonomic risks in mud mixing operations using fishbone diagram. The study leads to guide the occupational experts to judge the risk levels and to develop risk mitigation plans.

Keywords: Onshore Rig, Crude Oil, Fishbone Diagram, Mud Mixing Operations.

Depiction of Interaction and Effective Waste Management Planning: Design for Sustainability

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Abstract: Systematic waste management is an essential criterion for societal harmony as absence of it in recent times could lead to troublesome conditions for common people residing in urban and sub-urban areas of a particular place due to communication and awareness gap between concerned authorities and the masses. The implementation of technologically advanced garbage bins has been already proposed as a solution for the matter. To address the issue projected, a systematic planning design is essentially required that would be implemented through concepts of user interaction while also ensuring proper user experience to create a transparent scenario among the users. This paper aims at studying the user perception for proposal of an organized planning design that would address the communication gap that has been existent amid the users. The planning design would essentially deal with proper waste management in a particular area and the perception of the users on it was tallied through a questionnaire-based survey in Assam, India. The study also ventures through aesthetic aspects in regards to cleanliness and ensuring prospective for sustainable environment in the long run.

Keywords: Technology, Planning Design, Management Design, Interaction Design, Sustainability.

Fourth Ventricle Compression (CV_4) as a Method for Stress Management

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Abstract: Apart from stressful interpersonal and societal life situations, poorly designed learning environment and lack of knowledge of ergonomics increase the vulnerability of students to psychosomatic illnesses. Heart rate variability (HRV) has been used to assess emotional regulation capacity as a marker of stress and resilience. HRV is a window to the autonomic nervous regulation and refers to the physiological variation in the interval between consecutive heart beats. Fourth ventricular compression (CV_4) is a commonly practiced cranial osteopathic maneuver which has been found to bring about important physiological effects. This study assesses the CV_4 technique for its immediate effects on HRV parameters and thereby, its potential usefulness in stress management. In this study 25 male osteopathy students of Sri Sri University in the age group of 18-30 were voluntarily recruited. HRV parameters before and after the maneuver were recorded using Polar V800 Heart rate monitor and appropriate comparison was done using SPSS software. After the intervention, significant increases in all the time domain parameters viz. SDNN, RMSSD, NN50, pNN50 as well as logarithmic power of high frequency were noticed. This points towards a substantial shift brought by CV_4 maneuver in the overall autonomic nervous balance towards parasympathetic mode. This study shows that CV_4 brings about an acute parasympathetically dominated relaxation response in young adults and thus can potentially help in short-term stress management.

Keywords: Heart rate variability, Compression of fourth ventricle, Cranial Osteopathy, CV4, Polar V800

Experience of Cognitive Workload During In-vehicle Distractions

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Abstract: Drivers' ability to capture driving related information, interpretation and timely action upon that information determines safe driving. However, the cognitive resources of the driver to perceive, interpret, and execute driving related information are limited. The limitation of cognitive resources brings the issue of cognitive workload in focus. In the light of this understanding, the current study examines in-vehicle object and spatial distractions in terms of their effect on cognitive workload experienced by drivers. 47 drivers voluntarily participated in this test-track study. Equal number of drivers were randomly assigned to in-vehicle object and spatial distraction conditions. Drivers assigned to object distraction condition had to process object appearance information whereas under spatial distraction they had to process spatial information. After the completion of the drive, each driver's cognitive workload was assessed by using NASA-TLX. It was observed that there is a significant difference between in-vehicle object and spatial distraction with respect to their effect on cognitive workload. The results indicate that the drivers experienced more cognitive workload during object distraction. Multiple regression analysis of cognitive workload reveals that temporal demand, effort, and performance dimensions are significant predictors of overall cognitive workload, but the other three dimensions (i.e., mental demand, physical demand and frustration level) are not. Further, the stepwise analysis of the dimensions of NASA-TLX showed that temporal demand is the most dominant factor which contributed to 85% of the cognitive workload experienced by the drivers.

Keywords: In-vehicle Distractions, Cognitive Workload, Distracted Driving, Working Memory.

A Human Centered Approach to Redesign Prefab and Modular Bamboo Houses

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Abstract: Bamboo is one of the sustainable building materials in the world. Due to its durability, flexibility, low cost, lightweight, resiliency, easily cultivated and processed, bamboo is widely used. The building construction technique of bamboo is traditional and requires less time to construct. Bamboo along with metal can be used as a prefabricated (prefab) and modular building structure. The components of prefabricated houses can be constructed off-site, assembled and finished on site. Due to cheaper cost and time-efficiency, a prefab and modular housing system is the desirable strategy for quarantine center, isolation center, and temporary shelter for flood-prone areas. The aim of the research study is to redesign prefab and modular design houses using Bamboo material. The objectives include the study of traditional houses in Northeast India, different prefab and modular construction methods across the world, existing problems, physical properties of bamboo, treatment, and its uses. The methodology adopted for the study is divided mainly into three processes – Inspiration, Ideation, and Implementation. The Inspiration process includes a study from different works of literature of the concept of traditional housing, prefab structures, and different materials used with the HCD approach. Ideation includes the concept generation and ideas gathered and used in redesigning the prefab and modular bamboo houses. The initial Implementation or testing is done in the NID Assam campus and the performance analysis is carried and collected on the campus. This paper introduces a human-centered approach to the design and fabrication techniques of prefabricated modular bamboo houses, which can meet modern building requirements.

Keywords: Prefabricated Structure, Modular Construction, Human Centered Design, Sustainable Solution

Ergonomic Risk Assessment of Office Workers in a Consulting Firm in Kerala

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Abstract: Office workers often develop work related musculoskeletal disorders (MSD) in lower back, neck, upper and lower extremities. The study methodology includes systematic procedure to assess risk of MSD, analysis of office layout for environmental stress factors, digital human modeling for workstation design. The study identifies the prevalence of MSD and ergonomic risks among employees of a reputed environmental consultancy firm in Ernakulam district in the state of Kerala, India. The study sample com-prises of all office workers in the firm. Preliminary data on MSDs was obtained through a questionnaire survey (n=26). All the participants had MSD symptoms with back and lower body parts, and neck and up-per limbs problems. 70% have experienced MSD symptoms in the last six months. Ergonomic assessment protocol includes video recording of tasks and workstations, comfort measurement through questionnaire, workstation assessment by ROSA tool and measurement of environmental conditions such as temperature, sound, light and ventilation. ROSA assessment indicated the need for workstation rede-sign. Assessment of environmental conditions indicated the need to improve lighting, temperature and ventilation condition. RULA analysis of existing workstation using digital human modeling indicated var-ious workstation issues. Further work includes ergonomic redesign of workstation and workplace for the consulting firm.

Keywords: Work related musculoskeletal disorders, Office ergonomics, ROSA, Ergonomic design, Work-station, Office layout

The Revival of the Tribal Community by the concept of S.M.A.R.T. Village: A Case of the Sabar Tribe of Jharkhand, India

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Abstract: Majority of tribes in India are in a fragile state of dilapidation. Some of these tribes are categorized as primitive tribal groups owing to their meager socioeconomic status among other sociological factors. Sabar is no exception to this- mainly dwelling in Jharkhand, Chattisgarh and West Bengal. The community lives along the lines of a traditional primitive lifestyle, mainly dependent on forest resources- creating a lack of basic amenities such as shelter, sanitation & water supply. On the other hand, Sabars are proficient craftsmen- specializing in brooms, baskets, ropes etc. However, a lack of adaptation of these products to the current market leaves the craft with relics that cannot be sold at their required value. The Sabar craftsmanship is on the verge of extinction- the promotion of such tribal ethnic groups will not only restore the lost art, but will also increase the nation's GDP and in turn the global ethnic affairs. This document discusses how to adapt to the development of self-sufficient community solutions-providing them with reasonably priced & sustainable basic amenities, with the final goal to improve the community's living standards

Keywords: Tribal communities, fragile and dilapidated, skilled artisans, primitive, self-sufficient community, Sabar Tribe.

A Study on the Discomfort Experienced by Foundry Workers and Automation for Reducing the Discomfort

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Abstract: Metal casting foundry involves many activities that are prone to the ergonomic risk of musculoskeletal disorders (MSDs). This study finds the biomechanical load experienced by workers involved in manual metal pouring activity in small-scale foundry units and suggests an ergonomic intervention in the form of an automation system to reduce the biomechanical load. A sample of 12 workers involved in metal pouring activity from different foundries from western India is selected for analyzing biomechanical load. The biomechanical analysis is carried out using DELMIA-V5 software. The results indicate that the average compressive load on L4/L5 lumber for the selected population is 4365 N which is more than the limit of 3400 N specified by the National Institute of Occupational Safety and Health (NIOSH). The ergonomic risk is reduced by replacing manual activities with an automated system. A design of an automated ladle system for pouring molten metal is presented. The automation of metal pouring activity reduces the ergonomic risk and improves workplace safety. It is estimated that the cost of automation is 6 lakh rupees and the return of the investment will be 25% per year.

Keywords: Foundry, Musculoskeletal Disorders (MSDs), Biomechanics, Automation.

Discomfort Experienced by Students While Attending Online Classes During the Pandemic Period

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Abstract: Online teaching and learning method is widely adopted to provide a safe working environment to both teachers and students during the pandemic period. While this method is helpful to carry out the process of teaching and learning successfully, a few challenges lead to discomfort for both teachers and students. A survey was conducted to know the advantages and disadvantages of the online teaching and learning process. About 457 students have taken part in this survey. The responses given by them have been analyzed and the results are presented. There are many advantages in this system as follows: teachers and students need not travel to colleges and they can work from home, students need not walk a long distance in Universities following the choice based credit system, the PowerPoint presentation is available to every student at a distance for students to view them comfortably, the lecture is heard by every student at the required volume, students can learn at their own pace, teachers and students can enjoy the home environment as well as the care extended by family members while carryout the teaching-learning process virtually. But there are many challenges experienced by students while attending online classes which are as follows: They are distracted by a noisy environment, poor internet connectivity, clarity in teaching materials, feeble audio system, and traveling distance. Guidelines are given to students on how to cope up with the online teaching-learning process using the principles of Ergonomics.

Keywords: Online teaching-learning, discomfort, noise, internet connectivity.

Enabling Sign Language Recognition Feature in Video Conferencing

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Abstract: Pandemic situation has a major impact upon students in the mode of education. Students get back their quality of education through online mode supported by various platforms like Google Meet, Zoom etc. Still there exists a social group of students with oral and aural difficulties who suffer to get quality education online which is really pathetic to hear. Our paper aims to develop a special educational platform for the differently-abled students in order to make their conversation easier with a normal teacher through video conference (converting sign language into caption).as well as converting the voice of normal teacher into captions for easy understanding of differently-abled students (converting voice to caption).

Keywords: Indian Sign Language gesture, Voice recognition, Peer-to-peer Connections, Transfer Learning with Convolutional Neural Network, Tensorflow with Object Detection api.

Ergonomic Study on Farmers Involved with Cotton Harvesting in Haryana

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Abstract: Cotton is one of the essential fibers and is the cash crop of India, which plays a vital role in the agricultural and industrial economy. Cotton farming does not only serve the textile industry but stimulates employment and the food sector as well. As a state, Haryana is one of the main producers of cotton. Harvesting of cotton is done manually and is a laborious task. The workers involved in harvesting activities usually have observed the development of work-related Musculoskeletal disorders (WRMSDs). This study aims to identify the WRMSDs and allergic reactions among the farmers involved in manual cotton-picking tasks. Direct observation, Nordic questionnaire and Interview was used to collect the data regarding WRMSDs and the allergy symptoms among the worker. Farmers of old age group 36-50 and >51 were found to be more likely to report MSD symptoms in legs ($p<0.05$), shoulder ($p<0.05$) and lower back ($p<0.05$). The same age group also reported symptoms of cough ($p< 0.001$) and skin allergy ($p<0.05$), It was found that continuous bending, repeated hand motion and long working hours were the reasons for MSDs among the Farmers, and lack of usage of protective equipment and lack of knowledge about adverse effects of pesticide were found to because for the exposer to allergic symptoms.

Keywords: Cotton farming, Musculoskeletal disorders, Repetitive tasks, Manual material handling, Harvesting.

Game Addiction and Game Design: A Study Based Candy Crush Saga players

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Abstract: The emergence of mobile social games has increased the number of casual game players, allowing researchers to better understand the relationship between Internet gaming addiction and psychological factors among players. However, other factors such as game design must also be considered. The aim of this study is to learn how design factors like operant conditioning, game play, game design, isolation, cheating, and Nash equilibrium are linked to game addiction using Candy Crush Saga as the casual game. A questionnaire was distributed to Candy Crush Saga players to learn more about demographic characteristics, gaming addiction scale, and game design. A total of 206 responses were obtained from people aged 18 to 65. Data was gathered, and a multivariate statistical analysis was carried out. The findings of this study revealed that there is a connection between male and female addicts' professions. Several aspects of gaming are identified in the paper as contributing to adult gamers' addiction. We discovered that some aspects of Candy Crush entice players to use it as a mood enhancer. The HCI Contextualize! Personalize! Persuade! framework was used to suggest a solution. Or the CPP framework, which was created to track addiction via a behaviour change support system in Candy Crush and other gaming applications.

Keywords: Gaming Addiction, Game Design, HCI, Casual gamers

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ABSTRACT BOOK
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The Role of Postural Assessment Techniques in Different Workplaces- A Review

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Abstract: The struggle for the upsurge in productivity in industrial sector has become a necessity in present day's competitive world. The cut throat competitiveness has all the way come down from the latest machinery to the management of man with the machine. The management of human strength and psyche with respect to their working can lead to increased productivities. The wrong notion of squeezing out excessive work from workers has resulted in declined productivities. Industrials have now started realizing the need of the safe working environment for workers so as to bring feeling of security and belonging ness amongst the workers. Industries, being dynamic in nature should undergo periodic investigations so that any kind of health issue faced by workers could be located and resolved. In this paper, postural issues such as musculoskeletal disorders faced by workers have been discussed, and an overview of the postural assessment techniques, RULA and REBA has been presented. This work would serve as a guideline for the researchers who intend to study postural problems amongst workers.

Keywords: RULA, REBA, Musculoskeletal, Disorders, Postures, Ergonomics

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User-Centered Non-Suburban Indian Passenger Train

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Abstract: Indian trains are the commonly used mode of commute in the country. Indian Railways being the sole provider of train commute caters to 22.15 million passengers via passenger trains daily. LHB (Linke-Hofmann-Busch) coaches of Indian trains are mainly categorized as Sleeper, 3 AC, 2 AC, and 1 AC coaches, where the predetermined standards are contemplated in lower, upper, and middle berths. The authors intend to study the berth width of LHB coaches of non-suburban passenger trains regarding pregnant women. It has been studied that passenger with diverse dynamics and anthropometric variables find it difficult to adapt the same. This research aims to study the berth standards, and ergonomic concerns of intended passengers, through literature study, observations, and surveys. The following research examines relevant ergonomic factors, which can be considered in scheming the berth with suitable width. Further to these results are drawn and discussed from the study to formulate the conclusion.

Keywords: Adaptability, Berth width, Commute, Ergonomics, Inclusive, Trains

Assessment of Construction Workers' Musculoskeletal Disorders Risk using Quick Exposure Check Tool

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Abstract: The Indian construction sector provides employment to approximately 51 million people. It is the second-largest employer after the agriculture sector. However, the construction sector is the most hazardous sector across the globe. On average, 38 fatal accidents are reported daily in Indian construction. The main reason behind such a high accident rate is because most of the workers are illiterate, semi-skilled, or unskilled and temporarily migrated. Most of them do not have a quality of life, and they work 12 hours a day at their workplaces. Construction workers experience a high level of stress and suffer from musculoskeletal disorders (MSDs) during or after leaving their jobs. They have complaints about lower back pain, shoulder pain, which reduce their productivity. In this connection, this study attempts to assess the exposure to risks related to MSDs of construction workers by using the tool- Quick Exposure Check (QEC). The QEC tool has been referred for preparing the questionnaire. 75 construction workers involved in various activities were interviewed based upon a prepared questionnaire. Their responses are used to obtain QEC scores of multiple activities. The findings suggest that activities related to steelworks reported the highest QEC scores, indicating that the activities were the primary cause of severe MSDs. Shoulder and back had the highest exposure to MSDs. A fishbone diagram was prepared to discuss the root causes behind the issues. The work environment on-site can be made more suitable using ergonomic interventions to reduce MSDs in workers.

Keywords: Musculoskeletal Disorders (MSDs), Ergonomics, Construction, Quick Exposure Check (QEC).

Analyzing the Hand Grip Strength of Carpenters

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Abstract: The hand grip strength is an important performing characteristic that can increase the efficiency of workers. The hand tools should be designed in such a manner that the workers can easily perform operations with sufficient grip on it. This study was conducted to measure and compare the grip strength of the carpenters of age between 19-60 years. The hand grip strength of 112 carpenters was determined in different postures. The carpenters were selected from the population of Jaipur district of Rajasthan (India) and all were male and native of Rajasthan. Grip strength of dominant hand of each participant was recorded with digital dynamometer. An indirect moderate correlation was observed between age and grip strength. The hand grip strength of first group (19-32 years) was observed more compared to the other two groups (33-46 and 47-60 years). The findings of such research studies may be useful for product designers while designing products targeting a particular age group.

Keywords: Carpenter, Correlation, Grip strength, Hand tools.

Measuring the Work Stress Level among Nurses During Second Wave of Covid-19 in India

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Abstract: The purposed of the study to measure the work stress level of Nurses and their mental health outcomes due to second wave of Covid 19. An electronic survey was emailed to nurses who are working with the covid patient in in different parts of India from 2020 and 2021. A total of 40 responses were included in this study. Perceived Stress Scale (PSS) method was used to measure the perception of stress level and it is found that Nurses are suffering from (almost 83%) moderate stress level and 10% of them have high stress. Majority of the respondents were concerned with the stress related issues in their workplace due to this pandemic. Hence, the Nurses should discuss about the stress level they are experiencing, workplace adaptation during this covid, proper training and mental support.

Keywords: Covid 19, Nurses, Stress Level, Mental Health

Perception Shift Towards (Inter)personal Space: Public Transport and COVID-19 Pandemic

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Abstract: The pandemic disrupted transportation by hampering people's daily lives, affecting people's perception towards their (inter)personal space (IPS) while traveling. The study analyzes the change in transport behavior of commuters on six parameters which are clubbed into three aspects, i.e., transport behavior in public space, in personal space, and towards others while travelling. These aspects provide in-depth understanding of the shift in perception towards IPS while traveling prior to lockdown experiences (PLE) and with lockdown experiences (WLE) in the world's second-most populous country. The study examines the overall change in perception towards IPS while travelling considering sanitation awareness, personal space while travelling, preference for a personal vehicle, skepticism towards public transport, attitude towards fellow passengers and blue-collar workers in the health and sanitation sector, as important contributors to shape perception in the pandemic times. The results suggest significant change in transport behavior on all three aspects affecting impression for fellow passengers as potential carriers of the virus, and poor perception of sanitation in public places. The skepticism towards public transport increased yet not the preference for personal vehicle as it is not possible for every commuter to afford one considering the effect the pandemic caused on the economic condition of people. Sanitation awareness in individuals' IPS heightened while travelling and being in public place. The inferences highlight the need for spacious and sanitized transportation and the need for trust-building measures to restore the faith of people in public transport. A major policy reform incorporating public health concerns is required.

Keywords: Pandemic, IPS, Transport Behavior, Sanitation, Public Transport.

Kinetic Reciprocation in Landscape Architecture: An Exploration of Visitation Pat-Terns in Dutch Urban Parks

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Abstract: There has been a long-standing tradition of scholarly thoughts that visual perception is intricately linked to the possibility that the landscape affords for movement. The existence of a path facilitates our ability to see and experiencing the landscape, and its design articulation determines how we move through, and participate in it. This paper provides an understanding of the different movement patterns as a consequence of path design through the review of existing writings on the interdependence between the visual reception of gardens and kinaesthesia and an exploration of the routing design in three prominent Dutch Urban Parks. John D. Hunt's seminal work on movement patterns forms the basis for the paper's exploration into Amsterdam's Vondelpark and Utrecht's Máximapark, which have been chosen as the representative cases for Dutch urban parks. In doing so, the paper highlights the possibility of different movement patterns co-existing together and ways of designing for that. Additionally, the paper validates much of the existing theory on movement patterns and provides substantial points of observations to enrich it further.

Keywords: Kinaesthetic experiences, Poetics of Movement, Dutch Urban Parks, Routing Design, Landscape Architecture

Impact of Select Design Characteristics in Food Packaging on Consumer Behavior: A Study on Elderly Population in Kolkata

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Abstract: Nutritional label is one of the strategies to assist the public in making healthier food choice. Although an important aspect of food packaging, nutrition labeling is often overlooked; it is all the more important for elderly population where visibility and cognitive functions start to decline. In this backdrop, an attempt has been made to assess the impact of select design characteristics of food packaging on purchasing behavior of elderly population in Kolkata. Nutritional label for geriatric health drink was selected for the present study. 39 consenting individuals, (male n=18 and female n= 21) within the age range of 60 -75 years participated in the study. General physical and cognitive health status were assessed. Information related to preferences for packaging material, container, graphics, font and color were collected. Findings of the present work revealed that the study participants have specific preferences regarding packaging type and design. They preferred bottles, glass as packaging material, simple graphics, large font size and subdued colors. It was also found that they most frequently look for the product's best before use date, its manufacturer's name and product composition. Based on their preference, prototype for placing of relevant information on the product was designed and the response regarding noticeability, readability and likelihood of behavior change of the consumers was collected. It may be concluded that for a more inclusive purpose, continuous improvement in packaging design is important which will address the challenges for older people.

Keywords: Consumer preference, Geriatric population, Inclusive design, Packaging material, purchasing decisions, nutritional labeling

Cognitive Status of Adult Bengalee Males Undergoing Training in Football

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Abstract: Football, one of the most widely played body contact team game in the world, requires rapid motion, explosive running and jumping and other activities. In this context, a study has been undertaken on 33 randomly selected adult Bengalee males (aged between 18-24 years) receiving training in football constituting the Football Practicing Group (FG). BMI was found out. To assess lower level cognitive ability and cognitive flexibility trail making test (TMT) was conducted. Meta cognition of the participants was measured using D-KEFS Design Fluency Task (DFT). Similar tests were carried out on 36 individuals of comparable age, socioeconomic-ethnic status without formal training in any sports formed control group (CG). It may be observed, FG males have significantly ($P<0.05$) better cognitive status in terms of higher and lower level cognitive functions than their age matched CG males.

Keywords: Flexibility, Fitness, Mental Stability, Sports Performance, Mental Skill.

Cognitive Ability Improvement in Indian Classical Dancing: A Study in Bengalee Females

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Abstract: Lack of physical activity and increased longevity are having adverse impact on both physical and mental health in the adult population. Amongst other physical activities, Indian Classical Dancing (ICD) has its unique features including memorization. With this initial information, the present study aimed to investigate the impact of ICDs on the various cognitive abilities of healthy Bengalee adults. The study was conducted on female individuals having otherwise sedentary occupations and being trained in either Bharatnatyam dance (BD) or Kathak dance (KD) (age range 18 - 30 years). BD and KD had 42 and 54 females receiving training for a minimum span of 6 years and practicing either of the dances at least 360 hours in a week (at least 1 hour each day). The Control Group (CG) consisted 45 females of similar age, occupation, social and economic status but not undergoing any dance or exercise training. Cognitive performance analyses in terms of MMSE, SCWT, TMT, DSB and reaction time tests were done. It was found that the adult female individuals practicing BD or KD regularly have significantly ($P < 0.05$) favorable cognitive ability compared to their age, gender and occupation matched counterparts. The results suggested that BD and KD despite being a mode of relaxation helps in maintaining better cognitive ability. Thus BD and KD may be a potential tool and can be incorporated in the daily living agenda of adult females to facilitate maintain their cognitive performance and also improve the system performance as a whole.

Keywords: Mental health, reaction time, leisure time activity, lifestyle modification, attention

Assessing Lung Functions Status in Male Human Resources Engaged in Wood Processing Works using Surrogate Markers

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Abstract: Occupational lung disorder is becoming one of the major threat to human health in recent times and thereby, rate of mortality and morbidity is on high. Therefore, early assessment and diagnosis lowers the rate of such kind of lung functional abnormalities. In this background, a study was carried out on 37 Bengalee males (24 - 36 years) involved in wood processing works to assess their lung functions condition and to find out and/or validate the relationship, if any, present between select anthropometric variables and PEFR. Stature (cm), body weight (kg), trunk length (TL) (cm), arm span (AS) (cm), acromion height (AH) (cm), radial height (RH) (cm), stylion height (SH) (cm), dactylion height (DH) (cm), sitting height (Sit H) (cm), chest circumference (CC) (cm), waist circumference (WC) (cm), and hip circumference (HC) (cm) were measured, and PEFR was measured. Select anthropometric variables were significantly ($P<0.05$) associated with PEFR. Mathematical models were developed validated for use.

Keywords: Pulmonary Functions, Mathematical Models, Occupational Wellbeing, Anthropometry.

Bengalee Adolescents' Auditory and Allied Issues: A Study in Southern Bengal

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Abstract: Transportation noise including road and railway traffic noise is recognized as the foremost source of environmental noise exposure. Long-term exposures of transportation noise impose physiological stress in terms of cardiovascular disease and noise annoyance regarded as a health related outcome of well-being itself, leads to anger, disappointment, dissatisfaction, helplessness, anxiety, exhaustion also decrease the quality of life, including psycho-physical functioning, apart from hearing impairment. Concern to the context, here the work is conducted to evaluate the influence of noise exposure on the auditory health profile of total 255 male and 180 female adolescents (16 – 18 years). The information related to noise annoyance status and Quality of life was recorded. Also 243 male and 219 female adolescents of similar age, residing in a comparatively less noisy and quiet rural area, constituting the control group participated in present work. It has been observed that the study participants both male and female, residing in noisy environment are significantly suffering more from auditory impairment with higher level noise annoyance and significantly poorer quality of life compared to the control group individuals of similar age and sex, which may help to conclude that regular exposure to noise has negative auditory and allied impacts on the adolescents residing in noisy urban environment.

Keywords: environmental noise exposure, audiometry, auditory impairment, annoyance level, quality of life

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Impact of Practicing Bharatnatyam Dancing on Obesity Status in Terms of Adiposity Indices in Human Resources Engaged in White Collar Iobs: A Study in Bengalee Females

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Abstract: Occupationally engaged individuals spend a quarter of their lives at workplace and the type of job may influence their dietary habits and physical activity status. In white collar jobs, occupational sitting time of employees is much more compared to other forms and hence there is a high chance of becoming obese. Bharatnatyam dancing (BD), On the other hand, is a popular mode of recreational activity among Bengalee women. An attempt in this context was made to assess the effect of practicing and performing of BD on body adiposity status in Bengalee female human resources occupationally involved in various white collar jobs. Obesity status of 96 Bengalee women occupationally involved in desk jobs and regularly practicing BD has been assessed in terms of several conventional and relatively novel adiposity indices. Results are compared with 87 female individuals of comparable background except engagement with any form of regular physical exercise. It has been found that BD practicing group has significantly ($P<0.05$) healthy adiposity status in terms of both traditional and novel indices compared to their control group counterparts. As work characteristics of white collar jobs involve no or very less physical works during the working hours, lifestyle modification with enjoyable form of physical exercise is all the more relevant and in this regard workplace can be a target location for promoting healthy behaviors for the human resources.

Keywords: abdominal volume index, employee engagement, health promotion programs, occupational sitting duration, weight-adjusted-waist index.

Optimizing Roti making in Street Food Outlets: A Human Factors Perspective

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Abstract: Due to the ever-changing economic condition in the last three decades especially in urban and sub urban settings, women getting more and more involved in monetarily rewarding occupational activities, they find it difficult to devote enough time for cooking. Often hence, food is purchased from outside with the mobile apps or from the neighbourhood vendors. Roti, a flat round South Asian bread, is one such very common food that is purchased and consumed by many Bengalee households as it provides the advantage of being rich in fibres and also low in cost. But nothing comes free, its making is a little more energy demanding compared to other cereal based foods like rice and like. Hence, there has been mushrooming of roti making and selling outlets in every neighbourhood in urban and sub urban areas in West Bengal. In this backdrop, a study has been undertaken in different south Bengal districts on roti making including the maintenance of hygiene and sanitation in outlets, with a view to analyse the time motion components in the process to finally suggest a suitable method so as to reduce the ineffective time, if any. The components have been found out, compared and a process prototype has been proposed in order to reduce the ineffective time as far as possible reasonably in order to make the units more economically viable.

Keywords: Street Food, Ineffective Time, Time Motion Study, Breakeven Point, Hygiene, WASH

Personalizing Helmet Designing for Bengalee Adolescents receiving Training in Hockey: An Anthropometric Approach

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Abstract: Goalkeeping is specialized position in hockey especially from the standpoint of injury risks involved because of the nature of the game including the mass of the ball used. Generally, the helmets available are designed taking into consideration, the adult body especially the cephalic dimensions. But receiving training for developing into a well-trained player involves initiating the training process much before attaining the adulthood in tune with the philosophy catch them young. In this backdrop an attempt is being made to develop a design of a helmet meant for the Bengalee adolescents, who should ideally receive more protection from injuries for lack of skill and experience to protect them. The relevant anthropometric parameters especially the cephalic dimensions like head breadth and length were measured using spreading caliper from 48 consenting individuals. A personalized design of the helmet meant for the goalkeeper from the Bengalee adolescent population was proposed subsequent to mathematical modeling.

Keywords: Risk Management, Goalkeeping, PPE, Mathematical Modeling, Body Physique, Customized Design.

An Assessment of Seasonal Variations on Dust Exposure for Mine Operators of Central India

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Abstract: India is a mineral rich country the resources of which play a pivotal role in India's economic development. However, this is also accompanied with a significant contribution in fugitive dust emissions with different stages contributing directly as well as indirectly to air pollution and health hazards towards those involved in them. Mine workers as a direct consequence of their occupation are exposed to dust which in turn causes varied forms of pneumoconiosis based on the quantum of dust inhaled. The present study was conducted with an objective of studying personal dust exposure for Heavy Earth Moving Machinery (HEMM) operators working in iron ore mines and its allied plants (Crushing, Loading) in Central India. Trend of seasonal variations on personal dust exposure spread over two years for pre and post-monsoon sampling was also studied. Overall, the personal dust exposure was reported to be within stipulated Directorate General of Mines Safety (DGMS) guidelines. Seasonal trends in case of mining operations viz. Heavy Earth Moving Machinery operators however, indicated that the post-monsoon phase of the second year had lower dust concentrations as compared to the previous year. A similar trend was observed for each category of Heavy Earth Moving Machinery except drills. Contrastingly slightly increased dust concentrations were observed in the pre-monsoon phase of the second year as compared to the first year. Not much of an effect on dust concentrations was however seen on the crusher plants due to seasonal variations.

Keywords: Personal Dust, Iron Ore, Mining, Seasonal Variation, HEMM.

The Effects of Training with Two Smartphone Games Based on Stroop Effect and Reaction Time on the Processing Speed: A Pilot Study

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Abstract: This study investigates the impact of cognitive training on young adults using two smartphone games based on Stroop effect and reaction time respectively in Indian young adults. Similar studies are rare in the Indian context. In a pilot study, a randomized controlled trial was conducted on twelve college students using Spot the Number and Stroop Effect Challenge Android games available in Google Play Store. The twelve participants took a pre-test of digit symbol substitution test (DSST) and symbol search test (SST) and their performances in these standardized tests were recorded. Six participants each were randomly assigned to a training group (TG) and a non-training group (NTG). Participants in TG played the two games three times each day for twenty-one days. After this training regimen, a post-test was conducted on the twenty-second day. An increase in the mean score of the NTG by 4.59% in DSST and 4.44% in SST was observed; while the increase in mean scores of the TG was found to be 18.29 % in DSST and 16.35% in SST. After twenty-one days, statistically significant difference was observed in the performances of both the TG and NTG in the two standardized tests.

Keywords: Android Smartphone Game, Stroop Effect, Reaction Time, Digit Symbol Substitution Test, Symbol Search Test.

A User-Centered Comparison of Novelty and Typicality in Product Designs Using Pictorial and Augmented Reality (AR) Representations

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Abstract: Consumers prefer visually appealing products. The nature/mode of visual representation of a product has direct consequences for design and usability of screen-based user interfaces and work systems. Today, augmented reality (AR) based technologies using different devices, are being popularly considered for product representation. In this paper, a user perception-based comparison between AR-based and pictorial digital image-based product representation has been made using subjective inputs from Design students. Preliminary user-research was conducted to determine the most relevant design descriptors of product appearance for the design properties of novelty and typicality. The comparison between the two representation styles was performed on the basis of the following design descriptors found in the survey results - *creative, modern, unique, stylish* and *futuristic* (novelty) and *basic, common, old, classic* and *simple* (typicality). It was found that AR representations received favorable ratings to an extent of 6-8% higher than that of pictorial representations.

Keywords: Product Display, Augmented Reality, Novelty, Typicality.

Mind's Eye and the Cinematic Lens – An Analysis of Metaphoric Themes and Their Cinematic Adaptation in Kirsten Sheridan's '*Disco Pigs*'

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Abstract: Filmmakers often face creative challenges in transforming textual narratives into cinematic language. One such challenge is adaptation from a rich literary medium like a play to a film - a medium that relies less on verbal expositions and more on visual cues. In this regard, cinematographic techniques like Unity, Balance, Contrast, Colour etc. in composition and staging help with the encoding of the narrative and the subtext into the medium along with a metaphoric interpretation of the text.

Rudolph Arnheim's seminal work, 'Art and Visual Perception' (1974), laid the foundation for bridging the gap between principles of visual design and gestalt psychology. Taking from Arnheim's work, linguist Mark Johnson, in his 'The Body in the Mind', expanded on the metaphoric implications of embodied image schemata by using everyday experiences.

In this paper, we analyze how the principles of visual perception are presented in director Kirsten Sheridan's film '*Disco Pigs'*(2001). Referencing the work of Arnheim on visual perception and Johnson's theories of Conceptual Metaphors and the image schemata, the paper highlights Sheridan's cinematic approach in bringing depth to the story telling by allowing layers of subtext and emotion in the moving frame. The paper will illustrate the Balance Schema, through a visual analysis of the film compositions and the story/theme.

Keywords: Gestalt Theory, Visual Perception, Conceptual Metaphor Theory, Image Schemata, Visual Balance, Film

Ergonomic Risk Assessment of Rubber Tappers Using Ovako Working Posture Analyzing System (OWAS)

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Abstract: Natural rubber is a vital raw material for modern-day industries. It is commercially produced by extracting the latex of certain tree species that contain significant amounts of rubber and the process is called rubber tapping. In performing this operation, workers have to assume awkward postures, including extending of arms, side bending, twisting, flexion and/or extension of the neck, trunk, and wrists. Typically, workers tap at least 300 trees in a day, consequently subjecting them to these hazardous postures repeatedly. Such a cyclic and monotonous work activity involving numerous ergonomic risk factors exposes rubber tappers to great risks of musculoskeletal disorders (MSDs). This study was conducted among thirty rubber tappers in Kerala, India, to assess their working postures and evaluate their susceptibility to MSDs. Participants were directly observed while they were working, and their work activity was also videotaped with prior consent. The OWAS was used for carrying out a video-based posture analysis of rubber tappers to study the effects of their postures on the musculoskeletal system and the need for remedial measures. It was found that 30% of the participants had postures that would slightly affect their body, whereas 26% of participants had postures that had to be corrected soon in line with higher action categories.

Keywords: Ergonomics, Natural Rubber, Rubber Tapping, OWAS.

OSH Risk Perception of Safety Managers and Scope for Ergonomics Design Interventions in Floating Solar Photovoltaic Projects

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Abstract: Utility-scale Floating Solar Photovoltaic (FSPV) projects are being installed in large numbers on water bodies across India. The installation and maintenance of these new projects are mostly carried out by unskilled temporary workers exposed to emerging OSH risks. Such occupational risks can lead to multifarious safety and health issues for the workers. These risks need to be addressed through appropriate risk mitigation measures such as design interventions. This study has been designed to understand the risk perception of safety managers regarding the types and degree of OSH risks faced by the FSPV workers to develop contextual design interventions**.** A risk perception questionnaire was developed, and responses of safety managers (n=30) were obtained through a combination of in-person and virtual interviews. OSH risks in FSPV projects perceived by safety managers include fire, electrocution, solar radiation, heat stress, ergonomic risks, the threat from aquatic animals, hazardous materials, adverse weather conditions, skill gaps, etc. Safety managers are an important entity in the identification, design, and development of risk mitigation measures. The risk perception of safety managers will help as critical inputs for developing contextual design interventions for the FSPV workers. OSH risk mitigation is key in ensuring a safe and comfortable working environment for FSPV workers. The outcome of this study will assist industrial designers, ergonomists, safety & health professionals, and other industry stakeholders in designing and implementing appropriate design interventions from an ergonomics perspective.

Keywords: Floating Solar Photovoltaics, Safety, Design, Safety Managers

Analysis of Transplanting Activity Using Surface Electromyography

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Abstract: Transplanting activity involves women to work continuously in a bent posture resulting in musculoskeletal disorders. Muscle fatigue in the human body while performing a task can be studied using surface Electromyography. The experimental study was conducted among four healthy female subjects and they performed both methods of transplanting namely conventional method and with use of hand held seedling transplanter on ridges and furrows in a simulated environment. The mean MVC of the subjects were assessed prior to the start of the experiments using standard protocols. The percentage of changes in the sEMG for Abductor pollicis brevis, Extensor, Biceps, Trapezius was -15.9, -5, 2.2, 8.4 for right side as against -23.8, -3.0, -6.1, 3.9 for the left side while using Hand Held Seedling transplanter over the conventional method respectively. Analysis of the sEMG indicates that introduction of a simple tool such as Hand held seedling transplanter would result in avoiding awkward postures and reduction in the muscle fatigue and thereby increases the productivity of women in Agriculture.

Keywords: Transplanting, Farm women, Electromyography, Agriculture, Transplanter.

User Survey of UPI-enabled Payment Apps

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Abstract: This research paper suggests some measures that the app developers / designers of these Payment Apps can adopt to further improve the user experience and enlarge the user base of these apps. This research paper presents the results of a user survey of Unified Payments Interface (UPI) - enabled Payment Apps in India. It studies various aspects related to the most popular top five online Payment Apps used in India namely – Google Pay, PhonePe, Paytm, Amazon Pay and Bharat Interface for Money (BHIM). The main goal of this user survey is to find the usage patterns of these Payment Apps. Another important goal of this survey is to identify the most popular Payment App in India and analyze the reasons behind its popularity. This survey attempts to know the reasons for a significant population not using Payment Apps. The respondents were presented with a questionnaire with 18 questions. The survey, which was conducted online using Google Forms received a total of 228 valid responses and it covers a wide range of age groups which are (18-30), (30-45), (45-60) and 60+ years. Both male and female respondents have been included in the survey. The findings of the survey suggest that Google Pay is the most widely used Payment App in India and these apps are most popular among the younger age group of (18-30) years. This research paper also suggests some measures that the app developers / designers of these Payment Apps can adopt to further improve the user experience and enlarge the user base of these apps.

Keywords: User Survey, Payment Apps, UPI, India, Google Pay, PhonePe.

Influence of Yoga Practice on Body Composition and Cardio-Respiratory Functions of Adolescent Male

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Abstract: Yoga has beneficial effects on physical fitness and health of children and adolescent. This study was designed to observe the influence yoga practice on body composition and cardio-respiratory functions of adolescent male volunteers. A total of 168 male volunteers (age: 16–18 yrs) were randomly selected, and 68 were excluded and the remaining 100 were divided into (a) yoga practice group (n = 50) and (b) sedentary control group (n = 50). A yoga training protocol of 60 min/d, 6 d/wk for 12 wks was followed by the subjects of yoga practice group, where as no such training was given in sedentary control group. Measurement of body composition and cardio-respiratory variables were performed in both the groups at 0-wk and 12-wks. A reduction ($P < 0.05$) in body fat percentage, systolic blood pressure (SBP), diastolic blood pressure (DBP), resting heart rate (RHR) and respiratory rate (RR); and elevation ($P < 0.05$) in forced expiratory volume in 1st sec (FEV1), forced vital capacity (FVC), peak expiratory flow rate (PEFR), maximum ventilatory volume (MVV), and breath holding time (BHT) were observed among yoga practice group after 12 wks. Reduced ($P < 0.05$) body fat, blood pressure, heart rate and respiratory rate; and improved ($P < 0.05$) level of FVC, FEV1, PEFR, MVV, and BHT were seen in the yoga practice group when compared to the sedentary control group after 12 wks. It can be stated that regular yoga practice improves body composition and cardio-respiratory functions of adolescents.

Keywords: Body composition; Blood pressure; Lung functions; Yoga

Section- C

E-Abstract

Design of Workplace for Women Worker in Fish Dressing Operation

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Abstract: Fish dressing is a seasonal activity in which women workers were mostly engaged. Various health hazards in this operation were studied using ergonomic checklist and the workplace were developed and evaluated ergonomically. Interview based surveys conducted at Ratnagiri fish dressing industry and based on outcomes problems were rectified. It was felt to modify the workplace of fish dressing operation for that hand reach envelope was developed based on 5th and 95th percentile anthropometric values of women workers of Konkan region. Various dimensions of fish dressing platform decided using anthropometric data. Range of blade location and platform length was 400 to 500 mm from SRP and 920 mm respectively. The developed platform evaluated ergonomically, average WHR, work pulse (ΔHR), working OCR and energy expenditure rate (EER) of the subjects ranged between 109.8 to 117.2 bpm, 22.7 to 31.7 bpm, 0.51 to 0.60 l/min and 10.57 to 12.47 kJ/min respectively. The energy grade of work was classified under "very light" category. The seat height, depth, width, backrest height and platform height dimensions were 410 mm, 384 mm, 380 mm, 463 mm and 630 to 690 mm respectively. The average WHR, work pulse, working OCR and energy expenditure rate of subject was 114.2 (±3.12) bpm, 28.95 (±3.71) bpm, 0.56 (±0.039) l/min and 11.65 (±0.81) kJ/min respectively.

Keywords: Fish dressing, work place, ergonomic evaluation, hand reach envelop, Heart rate. Oxygen consumption rate

Evaluation of Operators' Workplace Layout on Indian Tractors

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Abstract: Tractors have greatly aided agricultural modernization in India. Most Indian manufacturers adapted western tractor designs to fit their Indian markets, which led to an increase in accidents. One of the reasons is the improper design of the workplace and control placement. The objective of this study was to evaluate the operators' workplace layout of tractors that are being marketed in India especially location of controls. The location of the controls, such as steering wheel, clutch pedal, brake pedal, and gear shifter lever etc. on ten selected makes and models of commercially available tractors were measured and superimposed on hand and leg reach envelopes made for Indian agricultural workers. The horizontal and vertical distances of centre of steering wheel of selected tractors with respect to seat index point (SIP) ranged 330-623 mm and 111-256 mm, respectively. The clutch pedal was located at 408-868 mm forward, 286-487 mm below and 253-351 mm laterally on left side of SIP. The brake pedal was located at 442 to 919 mm forward, 297 to 571 mm below and 205 to 356 laterally on right side of SIP. Based on the side view of the reach envelope, it was found that 8 to 58 percent of controls on selected tractors were either in the optimum area or in the maximum area. According to the plan view of the reach envelope, only 15 to 54 percent of the controls were in the optimum or maximum area.

Keywords: Tractor, Work place, Reach envelope, Optimum area, Seat index point (SIP), Controls

Evaluating Ergonomics and Disease Correlates with Safety Shoes Usage in Bokaro Steel Plant

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Abstract: Steel toe safety shoes complying with BIS IS 15298-2: Part 2 standards are in use at Bokaro Steel Plant (BSL). During shop-floor health risk assessment it was noticed that a major sets of employees were not using BSL safety shoes with a major complaints of musculoskeletal disorders (MSDs) and physical discomforts upon wearing the same.

A planned research study was initiated in April 2020 which included Anthropometric measurements of foot dimensions, Bio-mechanical reaction force assessments, Orthopaedic assessments of MSDs, Discomfort rating with Feedback questionnaire analysis on safety shoes usage. A total number of 638 (N) employees drawn from all major production shops were randomly selected and consequently assessed, tested and evaluated.

A high negative correlation (r = 0.43) exist between anthropometric dimension of foots and design variability of present shoes. Several bony changes on foots were identified due to abnormal gaits and also prolonged uses of defective shoes with lesser ergonomic compatibility. Higher reaction forces (R = > 10.8 N) experienced between harder shop-floor surfaces and harder outsoles may also causing significant strain at ball of foot, leading to MSDs as well as rejection of the shoes. Maximum discomforts were identified in the area of heel bottom, inside ventilation and weight of the shoes.

The study results indicate that non-usages of safety shoes at work by major employees are not an event of by-chance, out of carelessness or intentional violation of safety norms. The paper narrates varied ergonomics, bio-mechanical and orthopedic issues on safety shoe usages in steel industry.

Keywords: Safety shoes, Bony changes, MSDs, Ergonomics, Steel plant,

Looking at Social and Rural Development from a Multidimensional Perspective

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Abstract: Social and rural development is a vast area of discussion. It covers a number of themes where the main ideas are those of progress and change in developing countries. The core aim of social development is improvement in the well-being of every individual in society so that he/she reaches his/her fullest/highest potential/capacity/capability, whereas that of rural development is the reduction/elimination of rural poverty. A society's success is linked to the well-being of each and every member living in it. This paper is keen to look into, and understand social and rural development from a multidimensional perspective because both social and rural development are issues concerned with diverse areas of study and understanding. For instance, rural development is not only about agriculture but also about many other interlocking areas of concern like rural livelihood, rural education etc. Similarly, social development is a wide area that mainly has a people-centred/ people-centric approach but carries a range of issues within it; for example, factors like family and home environment, school-teacher, peer group, media etc have an impact on the social development of children. Social and rural development would enhance the growth of a vast area of discussion and deliberation. By this, the themes under it are vast and they go in line with the challenges and issues of developing countries. Let us look at multidimensional perspective as a way of understanding social and rural development. This would infact not only lead to good research but also build a platform for building new ideas.

Keywords: social and rural development, capability, rural poverty, multidimensional perspective, rural livelihood, rural education

Dimensions Identified for Physical Ergonomic Analysis in Manufacturing Industries: A Review

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Abstract: Productivity is an important measure for any manufacturing company. However, productivity can be significantly impacted by exposure to unfavorable ergonomic conditions. Work-related injuries are the most commonly reported issue in the active population of the industry. This paper mainly reviews the different factors of ergonomics that could possibly affect work leading to illness or accidents and musculoskeletal disorders which brings down the productivity of the manufacturing industry. Hence, an attempt is being made to identify such important factors to eliminate if possible or minimize work-related injuries and accidents to increase productivity. The main objective of this review is to identify those dimensions that are important in a manufacturing industry for physical ergonomic analysis. In this review Identification of some main important factors such as job tasks, workplace, machine safety, work environment, and work organization are studied regarding physical ergonomics. For future work, based on these dimensions we could develop questionnaires that can be used for the analysis of the workplace in manufacturing industries.

Keywords: Productivity, physical ergonomics, manufacturing industry, questionnaires

Muscle Activity and Postural Analysis while Using Smartphone

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Abstract: The smartphone industry is overgrowing with newer technology adoptions and increased usage. India ranks second among the highest smartphone users, with 400 million utilizers in 2020. However, excessive smartphone use could lead to physiological problems including back pain, shoulder pain, neck stiffness, and etc., caused by inappropriate postures. Therefore, it is required to analyze postures and associated muscle activity maintained during prolonged smartphone usage to reduce its adverse effects. The methodology follows subjective analysis and objective analysis with experimentation of 14 subjects of age group 18-30 years. Gyroscope and Myoware EMG sensor was utilized for head flexion angle and muscle activity measurement. The muscle activity of dominant upper trapezius, and head flexion angle were measured and correlated with RULA scores. It is observed that subjects maintained an average of more than 20 degree angles for an hour, indicating the posture maintained is highly risky or wrong according to the RULA chart. Also, these results ensure that the prolonged period of head flexion could lead to muscle fatigue. On comparing the average muscle activity at 0-15 minutes with 15-30 minutes, 30-45 minutes and 45-60 minutes, the muscle activity increased to 31.9%, 46.3% and 52.5%, respectively. This study analyzed the head flexion angle and muscle fatigue for prolonged smartphone usage. This study considered only one muscle (upper trapezius) activity and one smartphone. As a future scope, the study can be extended by increasing the sample size for different age groups, postures and other factors.

Keywords: Prolonged Smartphone Usage, Muscle Fatigue, Head flexion angle, Myoware EMG, RULA Score.

Ergonomic Evaluation of Students Posture on Lathe Machine used in Lab by RULA method

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Abstract: Lab safety is an important aspect for any college regarding students who will be working on machines for the first time. It is the responsibility of the lab supervisor to provide a safe and hazard-free environment for students by minimizing the risk. The current study focuses on the implementation of Rapid Upper Limb Assessment (RULA) in the lab which consists of different machines. The current lathe machine is outdated and the job includes movement and awkward position of students which cause various risks. Based on the research conducted it is said that there is a scope in the college labs to conduct an ergonomic study to create a safe working environment with minimum risk and effort. The machine shop lab has successfully implemented all the suggestions made by the authors without much investment involved. This case study is an attempt to create awareness and a healthy work environment through ergonomic interventions. RULA method found to be a useful assessment technique and acts as a proactive tool to handle safety issues in the lab.

Keywords: Lab safety, RULA, Ergonomic assessment, Machine shop

SMARTPHONES -A Major Contributor to E-WASTE

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Abstract: The contribution to global E-waste volume and also the resulting effects aren't uniform across regions of the globe. Smartphones pose a large prolem for various countries around the world. Manufacturers and agencies are lowly adapting new programs in an attempt to curtail the quantity of waste that has been rising over the years. Whereas smartphones contain a statistically si nificant increase within the contents of toxic materials. The trends in potential human health impacts and Ecotoxicity of waste smartphones are often analyzed through quantitative life cycle assignment (LCA) and positive identification method. Overall, these results will highlight the increasing importance of monitoring trends in materials use for electronic product manufacturing and electro ic waste management that may reduce the environmental effect and also promote the utilization of sustainable materials.

Keywords: E-waste, environment, sustainability, product and productivity, management, LCA, GREEN CARD, product, and productivity

Occupational Safety and Health in Agricultural Sector

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Abstract: With more than a third of the world's labour force employed in the sector, agriculture is the second largest source of employment worldwide after services. Women produce over half the food worldwide and in developing countries comprise 43 percent of the agricultural labour force. It is estimated that the women participation is expected to enhance about 50 per cent in 2050. Agriculture also involves a wide range of different types of machinery, animals, plants and products, working both indoor and outdoor environments under widely varying geographic and climatic conditions. While agricultural enterprises in many developed countries are highly mechanized and operate on a large scale, in many developing countries labour-intensive farming is much more common. Exposure to pesticides and other agro chemicals constitutes one of the major occupational risks. Such wide-ranging profiles, both in terms of employment and of enterprise, have a significant bearing on levels of risk awareness and on attitudes towards preventing accidents and diseases within the sector. Agriculture is in fact one of the most hazardous of all sectors. It is seen that out of 334 agricultural accidents, about 18.3 are fatal on an average. More than ever, there is the need to implement a comprehensive policy towards agricultures' safety so as to ensure the common pursuit of sustainable agriculture and development across the world.

Keywords: Occupational risk, accidents, ill health, women worker

Artistic View of "Smart Bus Terminus" Master Plan, Design and 3D Models for Implementation in Indian Cities

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Abstract: "Smart City" the terminology substituting the urban planning and progressively becoming the prominent concept of urbanism. Smart city components innovation and prototypes which will be helpful in effective understanding of smart cities design. India is a country moving towards becoming one amongst the developed nations, the source of revenue is highly dependent on the public contribution in various ways especially through the transportation sector. Population of India majorly comprises of middle-class income category. Their livelihood mainly depends on the regional level jobs and for the purpose of commute they prefer public transportation especially "Bus-Terminus". Application of scientific methods will enhance the quality of public mode of transportation and ensures conservation of natural resources depletion. The objective of adopting smart innovative solutions in public transport (especially bus stands) is to reduce pollution, congestion of traffic, improved safety, time optimization and cost reduction etc. Bus-terminals are an essential component in cities and involves everyday commute for the local population. The terminals existing in most of the Indian cities are poorly planned. It is necessary to implement modern strategies in terms of methods, interventions and infrastructure. In the present study, the attempt has been made to develop an artistic view of a "Smart Bus Terminus" which can be effectively used by urban planners and policy makers for planning and development. In this study, artistic view of plan, elevation and 3D models have been created using REVIT architecture and AutoCAD. Remote sensing and GIS techniques were used to identify the proper sites.

Keywords: Smart Bus Terminus; Smart City Component; 3D Models; Bus Terminals Design; Smart City Transportation; Artistic View of Bus Terminus.

Analysis and Correlation of Fitness and Strength Parameters in Volleyball, Basketball and Handball Players of University

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Abstract: Each team discipline presents a specific physiological and anthropometric profile because of some particular needs and functions. The primary aim of the study was to analyze the vertical jump power (squat jump, countermovement jump, countermovement jump with arm swing) closed kinetic chain upper extremity stability test (CKCUES test), throwing ball velocity, and handgrip strength among volleyball, basketball, and handball players, and the secondary aim was to find out the correlation of handgrip strength with all these parameters. Materials and Methods: A cross-sectional study where 75 university male volleyball (group A n= 25), basketball (group B n= 25), and handball (group C n= 25) players participated. Throwing ball velocity was measured with SRA3000 Radar Gun, vertical jump power was assessed by Force Platform (Kinematic Measurement System), and handgrip strength was measured by using a digital handheld dynamometer (CAMRY EH101). Results: By using SPSS version 21, One-way Analysis of variance (ANOVA) and Pearson correlation was found. Group A showed significantly higher scores in handgrip strength, vertical jump power and CKCUES test as compared to group B and group C. Handgrip strength showed a positive correlation with throwing ball velocity, vertical jump power and CKCUES test ($p<0.05$). Conclusion: Significant differences in fitness and strength parameters were found among all the groups and there was a positive correlation of handgrip with upper and lower limb strength. These findings will empower the coaches for objective selection of players on the basis of strength and fitness baselines as well as better understanding of injury risks.

Keywords: Volleyball, Basketball, Handball, Throwing ball velocity, Handgrip strength.

Facets of Job Satisfaction and Challenging Encounters in Dentistry: A Cross-Sectional Study

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Abstract: The aim of present study was to evaluate the level of job satisfaction among Indian dentists. Relationships with colleagues, relationships with patients, relationships with staff, personal time, community and administrative responsibilities were taken as the major attributes for the scale construction. The reliability of the Job satisfaction scale was tested with the application of Split-half technique, the standardized Cronbach's Alpha was found to be 0.78, the Split-Half correlation was found to be 0.66.From the self-correlation of the half-scales, the reliability coefficient of the whole test may be estimated by the Spearman-Brown Formula, and it was found to be 0.8. Age, years of experience, crowd of the patients, and annual pay were found to be significantly correlated with job satisfaction of the dental practitioners ($p<0.05$, $p<0.01$). This study suggests that patient relations, perception of income, personal time, and staff are the important factors for job satisfaction among dentists. The findings of this study will be helpful to policymakers to design plans in order to increase the level of job satisfaction.

Keywords: job satisfaction, dental practitioners, dentistry, career satisfaction, dentists

Alterations in Cognitive Performance associated with Mobile Phone Usage in the Eastern and North-Eastern Indian population

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Abstract: In this global pandemic where social distancing has become a norm, we are now more dependent on mobile phones, either for online classes or to work from home. As a result, exposure to Electromagnetic Radiation (EMR) emitted by cell phones has increased steeply. Recent studies have shown that harmful effects of mobile phone radiation on the neurophysiology manifested as increased irritability, rage and lack of attention. This pioneering study aims to find the relationship between phone usage and cognitive performance in humans. A cross-sectional study was conducted on 100 participants from Eastern and North-eastern India, within age range of 15-65 years, using Montreal Cognitive Assessment (MOCA questionnaire), modified for online mode due to the on-going pandemic. Younger participants (<30 years) use mobile phones for longer duration ($p<0.05$), particularly on social media, infotainments and online classes. Cognitive scores were better for people who engaged for lesser time in gaming and also used headphones ($p<0.05$). In contrast, participants who seldom used mobile phones for calling purpose only performed poorly in cognitive assessment. However, a significant association has been found between usage of headphones while calling with headaches ($r=0.214$, $p=0.044$), insomnia ($r=0.233$, $p=0.028$) and fatigue ($r=0.228$, $p=0.032$). Poor cognitive performance associated with excessive mobile usage was perphaps due to associated EMR exposure. Rare usage of mobile phones during the pandemic lockdown indicated social isolation and may be the reason for reduced cognitive scores. Suitable headphones can be used as an alternative to reduce the harmful effects of mobile phones on the brain.

Keywords: Mobile Phone, Electromagnetic Radiation, Cognition, Games, Headphones, Social Isolation

A Study on Newness in Electric Scooter Through Styling Exercises

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Abstract: An electric scooter that uses Li-ion batteries is more sustainable and lighter than a fossil fuel-based scooter with fewer parts and improved materials. That gives it adequate range to fulfil daily commuting needs, commuting cargo support system for people whose daily jobs include carrying cargo on their two-wheelers, e.g. newspaper delivery people, grocery delivery boys, courier delivery people, small shop owners, mechanics, plumbers, and electricians who carry their tools and machines on conventional two-wheelers that is scooters, mopeds and motorcycles. This design will make carrying cargo convenient. It has the necessary features of a modern scooter along that enhance the vehicles utility. Majority of people own two-wheelers in India due to their compact size and affordability. The vehicles available for personal commuting specifically in India such as scooter, mopeds and motorcycles do not provide any cargo support. The need for aesthetically pleasing vehicles is on the rise. The bag they carry it on their back which gives rise to severe back problems over time. So, this alternative will be a much safer and convenient for application. The findings advocate alternative support systems for the cargo vehicles for effective delivery in the near future.

Keywords: Electric two-wheeler, Cargo system, cargo scooter, utility vehicle, vehicle aesthetics

Lack of Civic Sense: Swachh Baharat Mission

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Abstract: Civic sense is the, ethics, behavior, and responsibilities of all the citizens for their city. In cities, as observed, the citizens do not use their civic sense, they do whatever they want to. Indian government launching many schemes and programs for improving the citizen's life but we see that the schemes are lacking due to misuse of civic sense and also their minimum involvement and responsibilities on the scheme. Swachh Baharat Mission(SBM) is one of the programs which encroaching to solve the sanitation and cleanliness problem in India. This mission aims to improve the sanitation and hygiene issues throughout the country and it's one of the objective to not litter and throw the garbage in dustbins, not in an open place, this objective indicated the citizen civic sense. By secondary data the result shows that Under the SBM program the waste collection is done door to door after that, we see waste on the roadside and even to the open space and sometimes in front of the house which shows the lack of civic sense of citizens toward their duties and responsivity. The paper concludes that the city government should take some good action for their city and citizen and do some awareness programs at the community level with the help of NGOs and the inhabitants should be educated thoroughly about the benefits of sanitation and hygiene.

Keywords: Civic sense, Swachh Bharat Mission, Sanitation, Hygiene, Public Behavior.

Post Shift Exercises to Prevent Repetitive Strain Disorders – A Trend that can be Started on the Shopfloor

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Abstract: How often have we seen workers do post shift exercises? It is a common phenomenon to see workers do pre shift workouts but never it happens that they do the exercises after the shift. Another important point is that it will also alleviate fatigue. First of all workplace assessment is done with respect to standing primarily. For example, in prolonged standing muscles like soleus, gastrocnemius and tibialis muscles are primarily affected. Secondly assessment is done with respect to upper limb strain. Taking another example in a moving conveyor assembly segment the muscles primarily involved are deltoid, biceps and triceps. Then we can chalk out specific OCCUPATION BASED POST WORK EXERCISES to relieve the worker of soreness and fatigue. The other main features which should be considered in making this OBPWE is - a) It should be a short work out session and not inculcate more aggressive moves which might result in more fatigue as part of Negative feedback mechanism b) Should help in relaxing all the muscles which were involved in the job. c) The total joules of OBPWE should not be more than 10% of the actual work of that period. The reduction in RSIs will imply that OBPWE should be promoted as part of the best shop floor practices.

Keywords: Shift Work, Fatigue, Repetitive strain, Injury, Occupational health, Negative feedback mechanism

Health Buddy – The New Methodology of Industrial Wellness

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Abstract: As far as understanding a "Buddy System" goes – it is basically two individuals working together/paired together to help and look after each other. As a trial in an industrial set up first a classification was created using the various levels of two most common chronic Illnesses – Hypertension and Diabetes Mellitus Type 2. The classification included grouping the various diseased workers into Red, Orange and Yellow categories and assigning a medical staff as a Health Buddy. The primary scope of work of the Health Buddy was broadly classified into Motivation, Guidance, Adherence, Result analysis, Co Ordination and Way forward. This included activities like Identification, Reaffirmation, Category Distribution, Counselling, Support, Follow up and Result Analysis.More than 95% employees in the borderline zone were converted to disease free category whereas in other segments more than 99% were converted into healthier categories. The total number of employees in the general illness diseased category was 155 which after 6 months of implementation resulted in 99% to healthier categories. Red was reviewed in a fortnight, Orange was reviewed once in 1 month and Yellow was reviewed once in a quarter. This implies that if wellness programmes are initiated in the plant level with a methodology of "Health Buddy" then there are better chances of achieving Well Being.

Keywords: Occupational Health, Wellness, General Illness, Psychology, Diabetes Mellitus, Hypertension

The Effect of Schoolbag Carriage on Adopted Speed and Handgrip Strength in Children: An Explorative Study

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Abstract: Handgrip strength is a screening tool indicative of upper extremity and overall body strength. Low grip strength is often associated with the sensation of fatigue. The physical activity of schoolbag carriage reportedly increases pain in the upper extremities. The aim of the study was to explore the association between upper extremity pain due to schoolbag carriage and the handgrip strength in children. 30 healthy male participants (10-15 years) walked for 20 minutes, at their preferred pace, either without or with a schoolbag (≥4% load of body weight) on both shoulders at mid-back region. The number of steps taken during walk was measured using a pedometer and average speed adopted was calculated based on stride length of the participants. Hand grip strength for both hands was measured for each participant before and after walk using a dynamometer. Significant differences were evaluated using t-test. The average speed adopted when walking with no load (130 cm/s) was lesser than when carrying schoolbags (160 cm/s) ($p<0.05$). Hand grip strength decreased significantly after walk for both left ($p=0.049$) and right ($p=0.046$) hands as indicated by paired sample t-test. The relationship between handgrip strength and speed adopted was inversely proportional but not significant ($p>0.05$). As higher speed is indicative of more exhaustive physical activity, the concurrent lowering of handgrip strength after walking with schoolbag for 20 minutes may be due to increased fatigability. This connotes the requirement of ameliorative measures, presumably, upper extremity conditioning exercises.

Keywords: Walking pace, upper extremities, dynamometer, physical activity, children

Application of the Novel PSAV Design Method for User Flow Hypothesis Validation in User Experience Design

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Abstract: Digital products are transforming human life in post pandemic time. User experience plays an important role in the life cycle of any digital product, it is one of the deciding factors for any product's success or failure among users. For designer (and teams) to cater positive experiences through their products, the basic idea (revolving around a problem statement or user requirement) has to go through various stages of the design thinking process. There are several conventional and popular methods e.g. functional test, UI Test, A/B test, etc. to ensure that product is going to deliver positive experiences to the users. These conventional tests comes at later stage of design thinking process and validating a concept for its user journey becomes expensive. The paper talks about the novel unconventional application of the PSAV design methodology to validate any user flow hypothesis for user experience design. The paper presents the method and application to leverage user experience through the PSAV design method.

Keywords: user centered design, PSAV method, user experience design, design thinking, interaction design, design management

Combined Effect of a Multi-Strain Probiotic and Prebiotic on Cognitive Processes, Body Composition and Exercise Performance on University Athletes After 15 Days Intervention

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Abstract: The mammalian intestinal microbiota directly affects the physiological performance and cognitive health of an individual. In this current study, our aim was to determine the effects of a multi-strain probiotic supplementation (35 Billion CFU plus prebiotic Fructooligosaccharides per day) on cognitive processes, body composition and exercise performance in university athletes during fifteen days of training. Twenty-one male and female active adults participated (10 women, 11 men, mean age 24 ± SD, 24.10 ± 1.89, age range, 21–29 years) in this single-blind, randomized placebo controlled, control group controlled, interventional and comparative study design. Via randomization, participants were assigned to experiment (Probiotic supplement; n=9) or placebo (n=6) or Control (n=6). At both Pre and Post time points, all participants were subjected to performance testing (Aerobic VO2 max test and anaerobic Wingate bicycle ergometer test), body composition analysis, cognitive tests (Online Reaction Time Test, © 2002 by Jim Allen and The Online Stroop Test) and Heart Rate Variability measurements. Data were analyzed by Multivariate Analysis of Covariance by time point design. Differences in the said variables were observed following the fifteen days intervention; however the difference was not significant. Significant difference was observed in the cognitive assessment before and after exercise testing. Probiotic supplementation in the university athletes did not affect the exercise performance, body composition, cognitive assessment and heart rate variability, significantly after fifteen days intervention. Further studies are needed to standardize the doses and time period of Prebiotic and probiotic ingestion on cognitive and physiological health of athletes.

Keywords: Probiotics, Prebiotic, Cognition, Exercise, Body composition, Heart Rate Variability

An Exploration of Multimedia in Communication Design

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Abstract: A communication is the exchange of information through a medium and design is its representation, it is used to address a message to be sent from the sender to the receiver effectively, in the process at times some of the sent message might not be directly relevant yet necessary for the sender to send it such that the receiver can use it effectively. In the case study provided the story of the caveman using his imaginative representation in being able to give emphasis to the viewer of the use of creativity in day to day activities. The use of a form of communication design multimedia animated graphic design using the perception of the caveman in using elements to express the visualised design from the rock he set out to carve and bring it as a form of entertainment for his uninteresting life. Line diagrams are the format of communication design used to emphasise on the imaginative representation of cave in which the activities are being documented, the line diagrams of the surroundings of the time period give emphasis to the scene. The human emotions are represented on the face of the cave man, that gives the inspiration for the cave man to derive the imagined design, which has been communicated as the final outcome of the cave man's design. The use of the auditory medium gives effectives for the viewer to get the message clearly the imaganative representation of relating to or occupying 3D space of the activities being represented.

Keywords: multimedia, creative, depiction, sense, motif, sound

Creativity in Digital Design: Comparison with Print-Based Graphic Design

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Abstract: These days, "always-online" mode of everyday life has raised concerns about its adverse effects on human factors, creativity, productivity, and our physical and cognitive health. The present research aims to conduct an extensive literature review on the media products through a comparative study between digital design and print-based design. In doing so, some publications related to this topic were identified from electronic databases like Google Scholar and Science Direct using appropriate search terms and reviewed. The literature search was restricted to journal papers, books, conference proceedings in the English language published between 1990 and 2021. Information extracted from the literature review on the differences between digital design and print-based design, were classified broadly under three categories: user-centred design methodology, design procedures, and designers' familiarity with digital technology. Following the systematic literature review, it is found that the differences in digital design and print-based design have impact on the human creativity while designing some media projects. The findings of the study provide future research directions to include a user-centred methodology during the design process to arrange for a more human-centric workplace. The current paper briefly discusses the process of applying (a) the human user-centred design methodology without compromising human creativity; (b) creating innovative design procedures to meet the design guidelines proposed for the target people; and (c) requirement of technological knowledge by the designers for successful design development. It is envisaged that there is an urgent need to include a user-centred methodology for enhancing creativity in digital design.

Keywords: Print media, Cognitive health, User-centred design, Design procedures, Digital technology, Print-based design

An Exploratory Study of Different Visual Textile Design Elements Representing the Culture of Madhya Pradesh State of India

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Abstract: The Government of India is promoting a lot of technological advancement through the digital India scheme and different states of India are also adapting this idea for offering different services to the native of their state through various means i.e. website, mobile application, etc. People of Madhya Pradesh are also showing a very high inclination towards new-age mobile applications. An inquiry was conducted among the citizens of the state who are using such applications and it is observed that the majority reported that such applications are not having the flavor of the state, maybe due to the absence of visual cultural elements of the state of Madhya Pradesh. Incorporation of such pictorial elements can give users a unique experience and can involve them emotionally. In the current exploratory study, different visual textile design elements related to the culture of Madhya Pradesh are explored and documented so that future websites/ mobile applications related to the state could consider it for inclusion.

Keywords: Digital India, online public services, emotion, Visual textile design elements, Madhya Pradesh, culture

Understanding Visual Cultural Elements of the Social Entry Gates of Assam from the Perspective of Native People of Assam

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Abstract: The meaning of gates as mentioned in the oxford dictionary is " the part of fence, wall, etc. like a door that can be opened to let people or vehicle through", the meaning suggests its utility of going through it. But from ancient times gates are built for society conveying some deeper intents and massages. Most of the time it conveys messages related to regulations, memorable events, culture, etc. Such intents and symbolic meanings are very less explored in literature. The current study on social gates aims to have deeper understanding of these intents from a larger cultural perspective. The exploratory study is conducted in a culturally rich Nort-Eastern state of India, Assam. The state has a great tradition of making permanent as well as temporary gates for society. Permanent gates are mostly built near the monuments or entry points of any special area representing its specialty. On the other hand, temporary gates are made near a place of social, religious, political, etc. congregation as a welcome gesture. People of the state give a lot of significance to such entry gates and carefully decorate it with different visual culture elements having deeper symbolic meaning. These cultural elements representing heritage of Assam are studied and documented in this paper so that the significance of such elements can be understood, preserved and considered for future gates.

Keywords: Visual culture, gates, social significance, native people, Assam, symbolic meaning

Study on the Effectiveness of Manufacturing Execution System (MES) in Manufacturing Industries

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Abstract: COVID'19 has severely impacted the global economy and all the industries throughout the globe. Earlier mostly companies had to put stop on all the manufacturing operations but now the lockdown has been uplifted in many parts of the world. Many remedial regimes are being followed in attempts to come up with a reliable treatment for COVID-19. At present, the approaches being used by the authorities are not prescribed by WHO. As the production is affected by the COVID'19-triggered lockdown, the use of manufacturing execution systems has reduced. Most of the revenue generated in the manufacturing execution system market is from the services provided in the market. As the services are directly proportional to manufacturing activities, the manufacturing execution system market is thus getting significantly affected by COVID-19. This has resulted in a lower estimated year-on-year growth rate for 2020 as compared. The shifting of an existing manufacturing environment to a manufacturing execution system involves various stages, which, when understood properly, enable small- and medium-sized companies to implement manufacturing execution systems in a cost-effective manner. Presently, the implementation of advanced manufacturing execution systems requires a proper software platform for the system, its integration with ERP, and data which needs to be exchanged within the internal software and MES software, which will help in decision-making. Small- and medium-sized companies are unable to implement advanced MES solutions as they require high investment. Also, they are not quite aware of the benefits of advanced MES solutions. These factors are currently restraining the growth of the market. This paper outlines the basic concept of manufacturing execution system in the manufacturing sectors and the importance of this system to elevate the manufacturing system to the next realm of Industry 4.0 in a manufacturing industry and the effectiveness of using Ergonomics in this system will reduce the risk of Ergonomics related disorders to the employees and in turn increase the productivity in the factory.

Keywords: Manufacturing Execution System (MES)

Electromagnetic Field Based Perturbations on Heart Rate Variability in University Recreational Athletes

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Abstract: Mobile phones, an integral part of the daily lives of almost 5.3 billion people worldwide, in operation emit a pulsed radio-frequency electromagnetic field (EMF). A few pioneer studies have reported the irreversible effect of EMF on brain electrical activity especially on cognitive performance. The current study was designed to evaluate the effect of acute EMF exposure on autonomic nervous system and other important physiological parameters of adult individuals while subjected to analytical and cognition task. Two tasks were assigned to twelve healthy participants; one analytical and one cognition task. Two sets of questionnaires were given to individual participant and they were subjected to respond it verbally: first, with cell phone and finally without cell phone. Continuous monitoring of autonomic functioning and other physiological parameters were done while perform. Performance of analytical and cognitive tasks, without the exposure of EMF, exhibited normal HRV indices and other physiological measures. Analytical task with EMF exposure showed significant increase of stress when compared to non EMF exposure. While cognitive task expressed an increase of stress in same fashion, the RMSSD increased in non EMF exposure (5%) in Task2 which was about 2 times (11%) than previous. Experimental evidence from this novel study identified the interaction between EMF and assigned task with a complex factorial design, including two different tasks. This type of studies, in turn, can help in speeding up of the process of determining the effect of frequent use of mobile phones, while doing complex daily tasks like driving, on physiological health.

Keywords: non thermal low frequency electromagnetic waves, mobile use, human physiology, HRV, cognition, analytical tasks

Cardiovascular and Autonomic Nervous System Alterations during Simple and Quick Balance Test in Healthy Young Indian Adults

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Abstract: Cardiovascular assessment & Heart rate variability (HRV) is strong marker of cardiac autonomic function and considered a potent parameter for cardiac-parasympathetic modulation as it mirrors autonomic nervous system. Observational monitoring isn't much effective and put erroneous interpretation while accurate individualized evaluation approach require. Therefore, continuous ECG and HRV measurement yields valuable information at beat-to-beat level. Timed up and go test (TUG) is widely used performance-based test and tool for clinical assessment. Literature has scarce evidence on HRV analysis of Indian population especially in different phases of TUG. It will serve as baseline data for further extrapolation. Sixteen (16) young adults were recruited for with 13 male and 3 female participants having mean age 23.5 ± 1.3 years and mean BMI of 22±2.7. ECG and HRV data were collected during rest, while performing timed up and go test and recovery period using a portable ECG/HRV device with video graphic analysis. Data was then analysed using Repeated Measures ANOVA. There were wide changes observed during different phases of TUG in multiple parameters which included RR interval, Heart rate, PR interval, etc. ECG and HRV can be incorporated in studying different movement patterns and can be both diagnostic and prognostic. This data will help us understand normal trend of heart rate in different phases of TUG. It can be used as a reference for future studies observing ECG/HRV changes during different activities among different population.

Keywords: TUG test, HRV, ECG, Balance, BMI, safety

Making the Furniture's Design Inclusive for Obese in HEIs: A Study in Bengalee Females

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Abstract: T2DM or Diabetes Mellitus (type 2) is on the rise throughout the globe irrespective of age, gender and like. India achieving the dubious distinction of being the diabetic capital of the world is having ever rising proportion of diabetics with more than 69 million diabetics, and disturbingly among the young adults and teenagers also. Obesity accounts for 80 % of risks in developing T2DM, a high percentage of young adults suffering from T2DM are hence obese; it also leads to social isolation. Despite attempts to manage obesity, by dietary intervention and exercise prescriptions, it is easier said than managed satisfactorily. This ever-increasing prevalence of obesity especially in urban and also suburban areas and consequently among students in Higher education Institutions (HEIs) located in these regions is hence a reality with which we need to learn to live with. A "general size fit all'' design of furniture for the young adults in HEIs hence deserve a relook. In this backdrop a study has been undertaken to assess the design of furniture presently available in HEIs. The relevant anthropometric measurements important especially for designing of the furniture in use at the HEIs were obtained from 36 consenting individuals attending HEIs in the age group of 18-24, BMI was also calculated and categorized, and the FBG level was also checked. The design deficiencies were checked, a prototype developed and tested.

Keywords: T2DM, Obesity, Inclusive Design, Anthropometry, Furniture in HEIs

Informal Urban Spaces and Place Identity

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Abstract: Urban informality is a critical aspect of spatial and urban planning. Urban theories often remain rooted in the idea of the utopian garden city, but several historic cities showcase outstanding examples of organic city planning and effectively respond to informality. In these contexts, the 'unplanned informality' is an exception to the formal order during the spatial regeneration of Indian cities and towns of heritage importance. Often the informality of these unplanned spaces has a strong impact on residents' minds and contributes to the place identity of the city. In the Indian context, the western concept of a strict master plan and setbacks are less relevant as rigid planning for future expansion is not sufficiently flexible and resilient to successfully deliver sustainable outcomes for the community. Therefore, an improved way of thinking is required: a new, integrated approach to urban planning that considers the unpredictable nature of community development and accommodates elements of change like contemporary activities. This study is done in the historically rich city of Bikaner in India. A survey of residents to understand the cognitive ergonomics issue shows that they want new urban design guidelines to be sensitive to the city's context. The multiple informal urban spaces in organic planning of the heritage precincts create an identity for residents and need to be preserved. Including these informal spaces in new planning guidelines would result in culturally sensitive built spaces that can strengthen the sense of place identity in the community and help in place branding.

Keywords: Place identity, Informal urban space, Urban informality, City branding, Historic town, Organic city plan.

An Ergonomic Design of Wheelchair for Paraplegic Persons

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Abstract: Wheelchairs are used all around the world by people who are differently abled or suffering from illness or injury. Now-a-days automated wheelchairs are available in the market. But, in the case of automated wheelchairs, the cost is not affordable to the majority of users. In the conventional wheelchairs, the risk due to the maneuverability is higher. The objective of this study was to reduce the risk in conventional type of wheelchairs during its usage by the paraplegic persons. Data were collected from the paraplegic persons to assess the perceived risk of wheelchair usage. The anthropometric data were collected from those paraplegic persons and the required design modifications were done as an ergonomic intervention in the wheelchair. The risk due to the maneuverability in rotating the rear wheels in conventional chair is reduced by introducing a ratchet mechanism. The dimensions of the wheelchair were modified by suiting it to the anthropometric data. A prototype of the wheelchair was fabricated and tested by the paraplegic persons. Based on their perception, the prototype provided them a higher comfort level than the conventional wheelchair. The research can be extended to the options of foldable and portable wheelchairs that can be operated by paraplegic persons.

Keywords: Wheelchair, Maneuverability, Intervention, Anthropometry, Paraplegic Persons.

Assessment of Frequency Use of Controls on Self-Propelled Combine Harvesters Under Dynamic Condition

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Abstract: A study was carried out to assess the frequency of various controls on self-propelled combine harvesters. The operational frequency of controls on ten different combine harvesters was measured during harvesting of the wheat crop. The controls were grouped into four (A, B, C, and D) based on their LSMEAN operational frequency (ISO 15077, 2002). The groups were arranged as follows: A > B > C > D. Only the steering wheel (1169.47 actions/h) was in group 'A' because operators used to hold it continuously throughout the harvest. It was followed by the header assembly control lever (361.03 actions/h) in group 'B'. The four controls, viz. the clutch pedal (121.17 actions/h), the brake pedal (95.03 actions/h), and the ground speed control lever (88.70 actions/h) were in group 'C'. The controls in group 'D' were the engine speed variation control lever (7.40 actions/h), the whole assembly operation control lever (6.40 actions/h), the header engagement control lever (5.33 actions/h), the reel position control lever (4.20 actions/h), and the thresher clutch control lever (3.70 actions/h). Controls in groups 'A', 'B', and 'C' were considered the most frequently operated, while controls in group 'D' were considered the least frequently operated. The most frequently used controls on self-propelled combine harvesters should be placed within functional reach of the operator and displayed prominently in the workplace design to make operation comfortable and safe for 90% of users. Likewise, the least used controls should be placed within the operator's maximum reach zone.

Keywords: Operational frequency, Controls, Combine harvesters, Functional reach, Reach zone.

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