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Challenges of Dispatcher Activities in Disaster Management

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Introduction

In spite of the substantial quantity of information, if there is no sufficient personal or technical foundation, the processing of information and the execution of the requisite measures when occurrences are identified cannot be conducted. In the dispatch centers of disaster management, artificial intelligence is assuming an increasingly pivotal role, but the human element remains crucial in operations. Operator engagement offers an extensive array of opportunities for inquiry into visual attention, search, observation, and perception, as these are dynamically evolving tasks that frequently necessitate concurrent processing of multiple incoming data. In addition to artificial intelligence, the significance of operators persists in perception and decision-making. Therefore, it is imperative to comprehend the cognitive processes involved in observation and perception.

In the field of disaster management, the dispatcher's activity occurs most often in the on-call and emergency services both in the case of fire and industrial safety's authorities and industrial site operators, where the use of technical equipment is of primary importance [1]. Wide application of camera systems is also possible in the field of disaster management. In addition to property protection systems, fire protection signaling and fire extinguishing systems installed for fire prevention purposes [2]. In addition to fire protection signaling systems, it is also particularly important the application of monitoring systems for the detection of dangerous substances that are primarily flammable and toxic in industrial environments [3].

Keywords: Operator activity, Perception, Continuous attention, Monitoring center

Enduring focus

The caliber of the operator's performance is significantly contingent upon the efficacy with which he can discern, comprehend, and supervise phenomena. The distinction between perception and cognition resides in the profundity of information processing: perception pertains to rudimentary responses to environmental stimuli, whereas cognition encompasses the deliberate interpretation of sensory information emanating from the environment. Numerous factors influence the proficiency with which an individual perceives, including their antecedent experiences, needs, motivations, personality traits, values, and attitudes. Furthermore, attributes of the object of perception, such as magnitude, motion, intensity, and familiarity, in addition to contextual elements, also exert considerable influence.

Human cognition frequently does not accurately mirror reality. The processing of information within our cerebral framework is affected by our experiences, the environment, and our individual perspectives and objectives. Prior experiences may distort our perception, as our sensory systems are “calibrated” to recognize specific phenomena and occurrences, while potentially disregarding others. Should an event be observed multiple times within a condensed timeframe, it may lead to habituation and heighten the likelihood of its subsequent disregard. Preconceptions established through our experiences are likewise reinforced in familiar contexts, which can skew the perception of reality. [4]

Perception and attentional mechanisms interact intimately with one another. Attention constitutes a cognitive function that enables individuals to discern pertinent stimuli and concentrate on them. Sustained attentional control refers to the capacity to maintain selective attention on a task for an extended duration while resisting both internal and external perturbations. Continuous attentional control is critically significant for operators when monitoring the displays within the control center. Sustained attentional control is also, in part, influenced by hereditary factors [5], but during maturation it is affected by either adverse circumstances (such as early-life trauma) [6], or beneficial influences (such as physical exercise or digital gaming) [7]. Attentional regulation is a competency that can be cultivated employing various methodologies [8]. Furthermore, the degree of attention is also contingent upon the extent to which an individual is recuperated. The attentiveness of fatigued or drowsy individuals is typically considerably inferior to that of those who are rejuvenated [9].

Numerous investigations within the domain of cognitive psychology examine the correlation between attention and perception [10] [11] [12]. In the absence of perceiving an object, it becomes infeasible to direct attention towards it [13]. When individuals engage in tasks that necessitate concentrated attention, they frequently overlook unexpected stimuli. This phenomenon was explored in the 1970s by Ulric Neisser and his associates [14]. The phrase “non-attentional blindness” was introduced by Mack and Rock [15]. Furthermore, there exists the concept of “change blindness,” which denotes the deficiency in the perception of unobserved alterations [16].

Operators are also significantly susceptible to non-monitoring and change blindness. It is critical to note that non-observational blindness is independent of the quantity of visual information an individual can perceive or retain; it does not predict a person's visual working memory capacity, functional field of vision [17], or proficiency in tracking multiple objects [18]. In particular event searches, non-observational blindness is more prevalent when the observer's cognitive attention is concentrated on locating a specific type of activity, thereby excluding other pertinent occurrences.

Since the capability of our focus is constrained, consequently, in instances of excessive stimulation, we may experience numerous deficiencies in visual perception. In the scenario of successive stimuli that transpire frequently, occurrences can be overlooked, i.e. the phenomenon referred to as attentional blink may manifest[1]. [19] Excessive demand can be precipitated, for instance, by an inadequately dimensioned display. If there is engagement on all displays, this can swiftly overwhelm the attentional capacity of the operator. To mitigate this, operators must employ augmented concentration of attention while executing attention-filtering mechanisms.

Wide range application of critical infrastructure protection systems is also possible in the field of disaster management, especially at the duty centres of disaster management headquarters [20-21]. In addition to property protection systems, fire protection signalling and fire extinguishing systems installed for fire prevention purposes [22]. In addition to fire protection signalling systems, it is also particularly important the application of monitoring systems for the detection of dangerous substances that are primarily flammable and toxic in industrial environments [23].

Communication

Communication assumes a significant role in operator activities across numerous domains. The exchange and interaction between the operator and the responding personnel is imperative to facilitate a successful execution. It is crucial to establish fundamental protocols to prevent disputes, [24] delineate tasks and obligations; however, in addition to all this, it is vital to cultivate an atmosphere in which individuals perceive that they are collaborating towards a shared objective. The capability of the operator to articulate information regarding the incident and associated reference points and milieu are critical determinants of success.

Extrinsic circumstances

For the efficacious operation of the human element, it is imperative to establish an appropriate ergonomic working milieu. The surroundings of the operators considerably influence the productivity of labor and the preservation of sustained concentration. Environmental factors, encompassing temperature, auditory levels, and illumination, affect individual dispositions, conduct, and overall wellness. A meticulously devised operator chamber fulfills the physiological requirements of operators, enabling swift critical decision-making. It is essential to conduct an ergonomic risk evaluation to formulate a suitable working environment and adhere to statutory obligations. During the conception, design, and execution, it is prudent to consider the MSZ EN ISO 11064 series of standards "Ergonomic design of control centers" and the minimum health and safety stipulations for work in front of the screen 50/1999 regarding (XI. 3.) EüM Regulation.[2]

Sufficient illumination is paramount to the optical tasks that transpire in the operator center, as the majority of the undertakings associated with data processing are executed by the human visual apparatus. Various illumination parameters (encompassing luminosity and chromatic temperature) exert a direct influence on the visual and cognitive efficacy of individuals. [25] Windows and the natural illumination they facilitate augment affect and assist in combating lethargy. The drawback of windows lies in the challenge of regulating the influx of natural light; consequently, during the design and execution phases, consideration should be directed towards shades or blinds, the positioning of the spaces, as well as the configuration of workstations and apparatus. Illumination should be moderate to guarantee optimal screen contrast and minimize reflections from adjacent surfaces. It is advisable to eschew a significant disparity between light levels, as the ocular system necessitates adaptation to variations in lighting conditions, and if a

[1] Attentional blinking is a phenomenon that embodies the temporal constraints of the capacity to captivate visual attention. This transpires when individuals are required to process two visual stimuli in rapid succession (within 200-500 ms). Consequently, the processing of the initial stimulus obstructs the perception of the subsequent stimulus.

[2] 50/1999. (XI. 3.) EÜM Regulation regarding fundamental health and safety stipulations for work in front of the screen.

substantial degree of adaptation is required, it may induce glare. Suitable localized brightness can be attained with desk lamps featuring adjustable luminosity. The MSZ EN ISO 11064-6:2006 standard stipulates a maximum ambient illumination level of 500 lx in video surveillance areas equipped with monitors. The disparity in the ambient lighting value between the ambient light directly at the screen and the surrounding environment (keyboard, desk) should not surpass a ratio of 1:3, whereas the ratio between the value measured at the screen and the ambient lighting of the most distant (room) environment should be 1:10. [26]

In addition to spatial illumination, other significant determinants are thermal conditions and moisture levels as well as air movement, all of which influence human thermal satisfaction. Disagreeable warmth and cold intensities diminish the sensation of comfort, can adversely impact efficacy in activities that necessitate considerable cognitive processing, while cold typically diminishes tactile sensitivity. The utmost efficiency is attained at thermal conditions approximating 22°C, whereas at 30°C, for instance, the efficacy is merely 91.1%, signifying a decrement of 8.9%. [27] Elevated humidity, as a general principle, augments the degree of perceived thermal sensation. For static undertakings in frigid conditions, the advised thermal range should be between 20℃ and 24℃, and the temperature differential between the cephalic region and the ankle (0.1 m to 1.1 m elevation) should not exceed 3 ℃. Correspondingly, during the summer season, the recommended range is 23 ℃ to 26 ℃, whilst the temperature differential between the cephalic region and the ankle remains constant at 3℃. Humidity levels fluctuating between 30% and 70% are deemed advisable.[3]

It is essential to attend to not merely the thermal regulation and air conditioning, but also to the provision of fresh, oxygenated, and unpolluted air. The velocity of air movement does not surpass 0.15 m/s. Excessive air speed can induce joint issues, muscular discomfort, and even ocular irritation and pruritus.

Acoustic disturbances also exert an adverse impact on productivity. Generally, elevated noise levels can culminate in diminished states of alertness, thereby impairing efficiency. Not all auditory stimuli are deemed detrimental. Communication related to occupational tasks can facilitate collaborative efforts and the effective transmission of information. Noise is a concept contingent upon individual perception — some individuals may find tranquility more disconcerting than cacophony, and what one individual perceives as noise may not be regarded as such by another. Preserving a diminished level of ambient noise is crucial for comprehending dialogues with colleagues or through communication devices. Acoustic disturbances may also be mitigated through the selection of appropriate wall and floor coverings or curtain materials. In addition to noise, due consideration should be given to various vibrations. Transient vibrations hold negligible significance for human health; however, protracted exposure can be detrimental, impacting performance. High-intensity and frequently occurring vibrations can induce fatigue, muscular spasms, joint discomfort, and tenderness, which may compromise work efficiency. In general, this factor need not be considered within the operator center; however, in certain scenarios, such as construction activities in proximity to central facilities temporarily, or surface or subterranean public transport vehicles, may engender this type of issue even on a permanent basis.

Workstation Configuration

During the formulation and functioning, it is prudent to consider the standard MSZ EN ISO 11064-4:2014 “Ergonomic design of control centers” and 50/1999. (XI. 3.) EÜM Regulation regarding fundamental health and safety stipulations for work in front of the screen. By

[3] The parameters for thermal conditions and moisture content are advised in MSZ EN ISO 11064-6:2006, which is predicated on the stipulations of MSZ EN ISO 7730:2006.

meticulously crafting workstations, the employer can shield employees from ailments of the musculoskeletal system, while concurrently enhancing productivity. Ergonomic design is paramount. Operators should be positioned with their hands, wrists, and forearms aligned, straight, and parallel to the horizontal plane. The nodding plane of the cranium should be level, directed forward, and not deviating to the left or right, or in alignment with the torso. To avert ailments, operators should be furnished with specialized ergonomic seating for 24-hour labor. The positioning of the various controls is critical, as improper localization can induce fatigue, and after extended exposure, even strain and injury. Monitors and other display apparatus must be situated opposite the individual utilizing them. The design should also consider the optimal viewing distance for monitors. Distance is influenced by monitor dimensions, resolution, and individual-dependent vergence[4], whose resting state has a more significant impact on ocular strain than the resting point of accommodation[5]. The resting point of the vergence fluctuates with the angle of observation. The smaller the viewing angle, the nearer the vergence rest point is. [28] Distance constitutes one of the paramount determinants influencing perceptual efficacy and exhaustion arising from extended observation.

Acoustic and visual stimuli can be located within the field control center. When orchestrating these components, it is prudent to consider the standard MSZ EN 62682:2015 "Management of alarm systems in the manufacturing industry." Auditory alarms should be chosen at a frequency that is distinctly discernible even amidst ambient noise. Visual alerts should visually differentiate from the background through the application of color, contrast, or flicker. The utilization of auditory signals to communicate a warning message can be particularly advantageous in more intricate visual settings or when heightened emphasis is warranted on a more significant peril, as auditory cues typically elicit swifter response times than visual alerts. [29] Acoustic indicators are typically coupled with a visual alert that guides focus toward the origin of the issue. Aural alerts ought to be employed to signify infrequent and more grave risks. This will avert operators from becoming desensitized to the overwhelming signal or inducing psychological strain from these notifications.

Abstract and Inference

The endeavor of operators denotes a multifaceted endeavor, the execution of which necessitates both material and personal prerequisites. In our inquiry, we scrutinized the competencies that an operator ought to possess and also addressed the significance of physical infrastructure. We investigated the rationale behind the importance of perception, cognition, and attention in operator functions, as well as the obstacles we may face in this domain. It can be asserted that an adequate physical state (efficiently functioning senses) is of paramount significance for an operator, yet concurrently, they must be capable of receiving, encoding, and processing information transmitted through nonverbal and verbal communication modalities. A well-functioning control center is inconceivable without the contributions of operators.

[4] The nearer the object is, the greater the extraocular muscles converge the ocular organs towards the nasal region. The eyes additionally possess a resting position, which fluctuates among individuals, but the mean is approximately 1 meter.

[5] Adaptation of the eye to distance

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