Holistic Ergonomics for the Evolving Nature of Work

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Ergonomics is broadly defined as "improving the fit between the person and their immediate environment." Over the previous quarter century, office ergonomics has emerged as an important force in creating healthful and productive work environments. However, in recent years the focus of office ergonomics has failed to evolve along with the increasingly collaborative nature of work and its variety of workspace types and locations.

The First People to Practice Ergonomics Were Engineers and Psychologists

The field of ergonomics was originally called "human factors" and began in World War II when engineers and psychologists began to examine soldiers' physical and mental capabilities. Engineers studied body size, reach and strength to make weapons easier to handle (ease of using the standard issue rifle). Psychologists studied how pilots gathered and processed information when operating complex aircraft (to improve layout of instrument panels and reduce accidents).

Today, the principles of ergonomics are applied to the design of an almost unlimited variety of products, software interfaces, and physical settings for human activity. In terms of the latter, the design of every type of setting imaginable, from children's playgrounds, to the interior of the space shuttle, is influenced by ergonomic principles. In addition, ergonomics considers the needs of special user groups such as the elderly, visually impaired, and people with differing mental abilities in the design of work, play and learning spaces.

Traditional Ergonomics

Engineering Ergonomics:
Study of body size, capabilities- fit of the workspace to the individual

Cognitive Ergonomics:
Mental work load, job tasks, software interface— the individual at work

The engineering and cognitive ergonomics approaches limit their scope to the individual in his or her workspace

Traditional "office ergonomics" has been practiced for decades, with a focus on the individual in their workspace. This area of ergonomics emerged directly from the engineering and psychology approaches developed during World War II. In fact, much of the data that influences office ergonomic standards today comes from a military database of soldiers' body dimensions.

Engineering ergonomics focuses on body size, physical capabilities (also known as "anthropometrics") **to improve the fit between people and the office workspace.**
Typically trained as an engineer or in health and safety, an engineering ergonomist who works with office environments can develop workstation design specifications or training on how to use seating or work tools to minimize injury. While this approach plays a significant role in determining design and furnishings in the office, it focuses exclusively on the body mechanics of work. The engineering approach is limited because it does not consider the "mental" part of work— decision-making, work process, and similar issues.

Cognitive ergonomics seeks to optimize the fit between technology, job design, and mental capabilities.
Cognitive ergonomists are usually trained in psychology, and focus on "job design" issues (as opposed to physical, workspace design)— developing job tasks that address issues such as mental work load, decision making and work processes. In an office setting, a cognitive ergonomist's role could be to develop training programs to help call center agents effectively use software systems to provide the best service to customers— or even to redesign the agents' jobs. Cognitive ergonomics is limited because it does not consider the physical context of work.

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For 25 years, these two traditions have dominated the practice of office ergonomics.
The scope of concern has largely been limited to *individual computer work* in the primary *office workspace* with a desired outcome of reducing discomfort or preventing injury, or increasing individual work efficiency. Both approaches narrowly focus on the "micro" work environment— the immediate space around the worker and computer. And in practice, both approaches operate in isolation from the other.

The Changing Nature of Office Work Is Creating New Opportunities for Office Ergonomics

The majority of work today is "knowledge work" in which people work with intangible work materials, and in many cases the output of this work is also intangible. The nature of this work is highly collaborative and social; and work now happens in a wide range of locations, with almost half of all work occurring outside the primary workspace.[1] Further, two recent studies found that even when employees are at their desk, the average amount of time spent on the computer is only about 2.5 hours per day.[2,3]

Thus, there is a disconnect between the limited breadth of issues that office ergonomics currently addresses, and the broader direction in which office work is evolving.
If we focus on only a fractional part of office work (individual discomfort and posture during interaction with a computer), we risk missing many opportunities to enhance the well-being and performance of office workers.

As The Concept of "Office Work" Broadens, the Practice of Office Ergonomics Must Evolve to Embrace a Holistic Perspective

A "holistic" approach to office ergonomics not only integrates the engineering and cognitive perspectives, but also expands the range of issues and workspaces addressed by the ergonomist.

This broader range of issues includes informal and formal collaboration, the social aspect of work, learning and mentoring, group productivity and other concerns of today's interactive knowledge work.[5,6]

As well, holistic ergonomics is applied to the design of a much wider range of workspaces beyond the individual workstation: the large scale interior work environment, and the planning and furnishing of all individual and group spaces and their adjacencies.
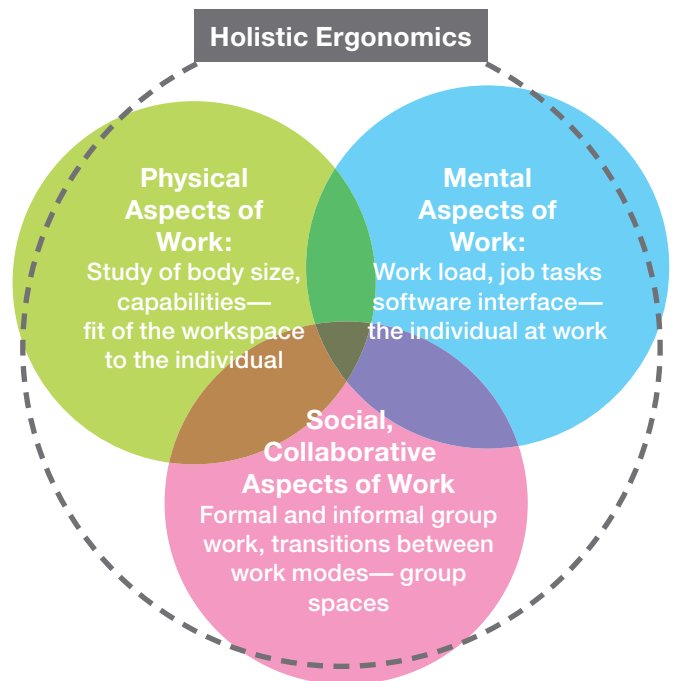
Holistic ergonomics broadens the scope of engineering and cognitive ergonomics, to include the social and collaborative context of work, group workspace and overall layout of space

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Holistic ergonomics recognizes that the physical, mental and social dimensions of work must be addressed together for a successful solution.

The scope of holistic ergonomics has the potential to broaden the domain of responsibility for ergonomists into new territory— the design and layout of the overall workspace and a wider variety of collaborative workspaces. Forward thinking ergonomists embrace this opportunity to apply ergonomic concepts on this larger scale and to benefit the whole organization by lending expertise to interior design and facility planning decisions.

Holistic ergonomists may be trained in any of a wide variety of disciplines.

Holistic ergonomists' backgrounds are varied: engineering, psychology, health and safety, architecture, interior design, facilities management, change management, organization development, and other fields. They would probably have significant project management experience. Within a workspace project, a holistic ergonomist could serve as a point person, integrating the activities of office ergonomics with interior design, workspace planning, facility management, workspace strategy, human resources and IT, depending on the situation.

In the course of social interaction with others, we literally turn our attention from one thing to the other. These are new and important ergonomic considerations for the design of space.

The holistic ergonomist is a generalist, synthesizing individual, group, and organizational needs and coordinating the delivery of an integrated workplace and program to support work needs at all levels. The point of this holistic approach is to create successful work*places,* not just successful work*spaces.*

The workspace should support the social component of collaboration.

Holistic ergonomics addresses the social component of collaboration, which includes learning and mentoring, exchanging information about "how things get done" in the organization, and other purely social exchanges.

The social component of collaborative work brings new movements and behaviors to the work setting that have not been previously considered in office ergonomics. Collaborative work now involves a constant shifting of attention and, thus, is more visually interactive, with the eyes and physical orientation of the body frequently moving between coworkers and other objects involved in the task. Gesturing and sketching are often important functional components of the interaction. These are new and important ergonomic considerations for the design of space.

The workspace should enhance transitions between individual work and collaboration.

Office work is dynamic and constantly changing. It is also highly fragmented. A study of office workers found that, on average, they spent 11 minutes on any given task before they switched to a different task or before that task was interrupted. They then worked on approximately two other tasks before returning to the original, interrupted task.[7]

However, interruptions may sometimes enhance the work being done. Research showed that a significant proportion of interruptions trigger a transition between an individual work mode and collaboration. This collaborative work was generally seen as a "productive interruption." A second group of researchers found that office workers spend a significant proportion of their time interacting with others, and the majority of these interactions were face to face.[8]

Research shows that the workspace is more effective if it is designed to offer environments that facilitate varying degrees of individual and collaborative work— and ease of transitioning between these work modes.[9]

Flexibility of workstation components, especially seating, in accommodating these postural changes and their differing physical requirements plays a role in minimizing discomfort as well as affecting the ability to make successful transitions between individually and collaborative work.

The ability of workers to control these transitions is critical. Studies of office worker performance have found that individuals working in flexible, adjustable workstations performed significantly better than a control group, but only if they were trained how to utilize and tailor the workstation to match the work performed.[10]

Thus, the ergonomist must be concerned with the ease of transitioning between individual and group work within the workstation— in addition to supporting changing postures as part of individual computer work.
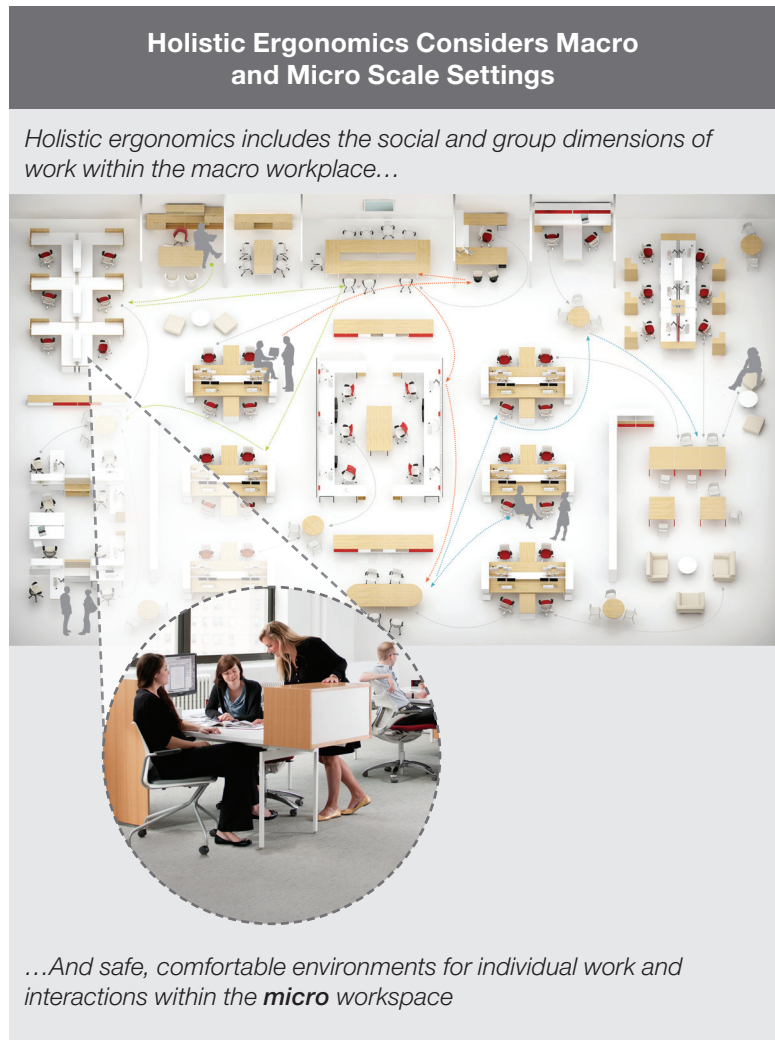
The Practical Application of Holistic Ergonomics Occurs at Both the Macro and Micro Scale

Environments should be designed based on ergonomic principles from the engineering and cognitive perspectives— which focus on individual work within a workstation. But we shouldn't stop there. Using the holistic ergonomic approach, ergonomists should expand the scope of their influence to better support social interaction and group work, and correspondingly, the scope of space from the individual workstation (micro environment) to the large scale interior workspace (macro environment).

Thus, the influence of holistic ergonomics starts at the macro, "big picture" level, and includes micro level work and workspace. With this approach, all elements of the entire workspace are integrated for a successful solution.

Holistic ergonomics includes planning at the macro workplace level.

Workspace planning is a process that is used to envision the overall layout of workspaces within the facility or floor plan. The general emphasis is to plan for the greatest flexibility of the interior space and, thus, provide employees with the greatest choice in selecting a space that meets their immediate needs:

Holistic Ergonomics Considers Macro and Micro Scale Settings

Holistic ergonomics includes the social and group dimensions of work within the macro workplace…

*…And safe, comfortable environments for individual work and interactions within the **micro** workspace*

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**Start by determining the space requirements for work zones.**

+ Create the right number, and appropriate mix of work zones designed to support varying combinations of individual and collaborative work. Each zone could include individual or shared workstations, huddle rooms, project rooms, etc.

+ Within each zone, define the location, size and density of each type of workspace.

Use the space to support interaction, optimize workflow, and communicate social cues.

+ Reduce the overall horizon height of the walls and furnishings to increase visual access and ease accessibility to other locations and resources.

+ Provide the right variety of horizon heights to support the work in each work zone: low horizons support collaboration and mid-height panels assist focused work.

+ An open line of sight to co-workers provides important social cues that can minimize interruptions by offering insight as to when someone is available for interaction.
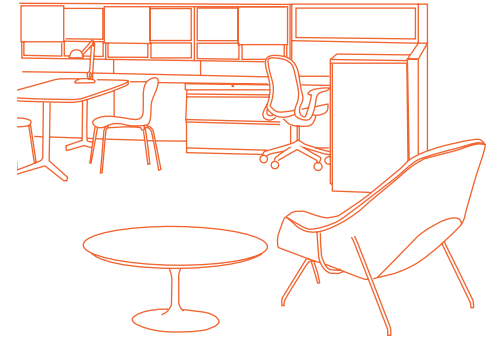
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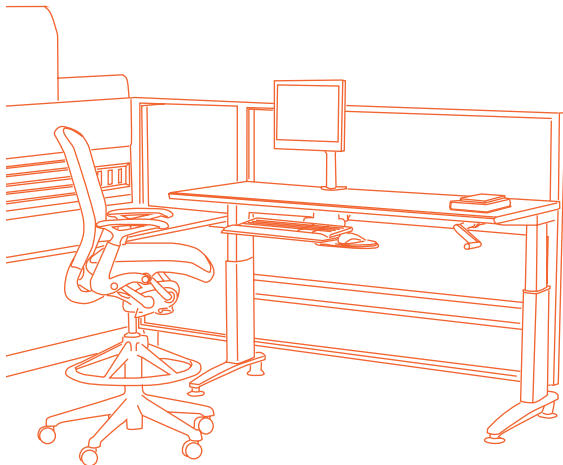
The workspace should provide features and furnishings such as height adjustable table, moveable keyboard tray, monitor arm, and full height adjustable seating that work together to provide maximum flexibility so the user can adapt to changing work process needs.

Holistic ergonomics considers work needs at the micro workspace level.

Supporting the increasingly interactive nature of work starts with creating adaptable workspaces that improve employee control, leading to a healthy and safer work experience:

**The workspace should be adaptable, serving multiple functions.**

+ A highly adaptable workspace could use freestanding furniture elements that can be shifted and moved in response to the individual or collaborative work at hand.

Workspace furnishings and elements should be adjustable.

+ After observing the range of tasks and interactions occurring within the workstation, ensure the technology and work tools are arranged in a way that supports the flow of work tasks.

+ It may not be possible to anticipate all tasks that will occur in a workstation. Thus, specify furnishings and technology that can be adjusted or moved by the worker—worksurface height, work chair, monitor arm, storage elements, etc.

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Support casual interaction in or near the primary workspace.

+ The workspace should permit quick, informal meetings (visitor seating, collaborative worksurfaces, marker boards, etc). Ideally, this interaction should be supported either within the workstation or a few steps away. For instance, an adjustable monitor arm allows several people to view a screen. Wireless input devices (e.g., a mouse) make it easier to share the device with others during a casual meeting.
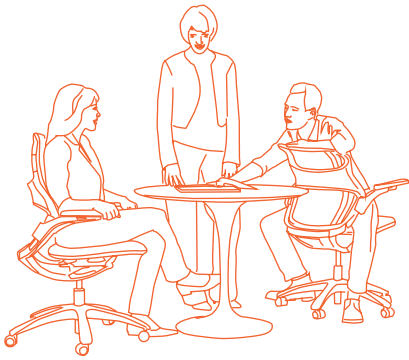
The workspace should have flexible furnishings and seating that support fluid transitions between individual and collaborative work

Seating should support frequent shifts across a wide range of postures.

+ Recognize that people constantly change position and posture— to stay comfortable as they conduct individual work tasks, and also to transition between individual work and interacting with others. The movements may be small, such as slightly shifting one's weight in a chair, or they may be more pronounced, such as reclining, then sitting upright. Consequently the seating used in offices must be able to adapt and follow the associated postural changes.

+ The ability to move with and support the user while he or she makes these postural changes without requiring the user to adjust controls is an important function, especially since postural changes occur frequently.

Holistic ergonomics provides the inspiration for healthy and productive workspace solutions

To reduce discomfort and risk of injury, ergonomists routinely specify flexible ergonomic seating, adjustable height worksurfaces, task lighting, moveable monitor arms, and other elements. Beyond their healthful benefits, these features can also be used to support the constant transitions between individual work and collaborative interactions that form the cornerstone of effective knowledge work today. Studies have shown consistent health and performance outcomes between workspace features that provide flexibility and support these transitions.[11]

"Good ergonomics" can benefit the organization in two ways. The goals of traditional ergonomics (reducing injury and efficient work process) are met by fitting the workspace to the person. Beyond that, the holistic approach applies ergonomics principles to create workplaces that enhance group and organizational performance by supporting the fluid and collaborative nature of knowledge work today and in the future.

The holistic approach elevates the typical view of office ergonomics from protecting the organization from risk (i.e., injuries or accidents) to a function that recognizes broader organizational and business issues and responds with successful workplace solutions.

Seating should support a wide variety of potential postures for individual work, and the ability to transition between individual and collaborative work

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End Notes

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