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Fitting Ergonomics to Engineering Work


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For a more in depth look at this subject, please refer to:

Mekitiak, Megan, "Industrial Engineers on their Current Practice: Implications for the Integration of Social and Technical Sub-Systems in Work System Design" (2009). *Theses and dissertations*. Paper 132.

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INTRODUCTION

For ergonomics to be most effective, it must be introduced to design projects as early as possible. There are numerous benefits to early inclusion, including increased ease and flexibility for design changes, reduced costs for redesigns or retrofits and the introduction of more productive, healthy work systems from the beginning of their life-cycle. However, in order to coordinate early introduction of ergonomics, ergonomists need organizational support, particularly from design departments. As a result, ergonomists must work with stakeholders in many other professional groups to achieve their objectives, one of which is engineers.

Many ergonomists report difficulty engaging with engineers in design stages. It is our position that by ensuring engineers' goals are met, ergonomists may be better able to integrate ergonomics considerations into the daily work of engineers and into the entire design process. One step toward this result is for ergonomists to understand the objectives, motivations, and working routines of engineers.

INSIGHTS ON ENGINEERS AND ENGINEERING WORK

In reviewing available research on engineering practice, we have identified 10 points for ergonomists to consider when attempting to build better working collaborations with engineers. These points are not intended to be exhaustive or conclusive. They are intended to aid ergonomists working with engineers (or any other stakeholder group) in developing an effective plan to integrate and support ergonomics in the design process.

1) Engineers are diverse: Engineers are a widely varied group. Even within a discipline (e.g. civil, mechanical, chemical, etc.) their attitudes, priorities and working style may differ by level of experience, role in the organization, and the surrounding culture. For example, engineers display differing attitudes toward human factors between disciplines.

Due to this variability, prior experience dealing with engineers may not hold and it can be difficult to know your audience when entering a new organization. Take time to learn the "culture" in the engineering department(s) you are working with. Find out what is expected of them on a day-to-day basis, their immediate priorities and their long-term objectives and try to appeal to these concerns when making a case for ergonomic aspects.

2) Engineers are open to ergonomics: A generally positive attitude toward the inclusion and improvement of human factors was reported in surveys of engineers.

Engineers can be a receptive audience to human factors concepts if they are introduced in a way they understand and that complements their existing roles, responsibilities and job requirements. When introducing new ideas, find ways to integrate human factors into everyday tasks and routines to ensure the right supports (tools, management support, access to experts, etc.) are in place. In addition, build on positive outcomes by emphasizing gains in all parts of the system, such as improved quality and productivity.

3) Perspectives can clash: Engineers often work in multidisciplinary teams, though team members tend to share a technical focus. However, people with different backgrounds will address problems differently leading to more challenging team dynamics. For example, there may be conflict when people with a primarily social focus work on projects with those having a more technical focus.

It is probable ergonomists and engineers will view systems from differing perspectives and that people you are working with may not intuitively understand the way you are approaching the problem at hand. It may be useful to have a design team deliberately alternate their focus between technical and social foci in an effort to make sure all parts of the system are considered. This could also help team members gain new perspectives. In addition, take note of how engineers are defining design parameters and try to frame the problem in these terms.

4) Engineers are constraint-driven: Engineering designs must operate within existing technical, social and business systems and are therefore subject to various constraints including financial, legal, contractual, political, social, and especially project timelines and deadlines.

Engineers will be wary of additional work that does not fit into project timelines. They will also be wary of additional constraints on their work. It is essential to have management support, particularly from engineering managers, to overcome this barrier. Time spent on human factors issues must be planned,

10 Tips for Working with Engineers

1. Learn the “culture” in the engineering department.
2. Introduce human factors in a way that complements existing practices.
3. Acknowledge differences in perspective and use ‘perspective-swapping’ to help designers consider both human and technical aspects of a project.
4. Ensure management support and encouragement for engineers’ ergonomics efforts and successes.
5. Design is a series of compromises. Appeal to stakeholders’ goals and objectives to win buy-in for ensuring ergonomics constraints are explicit and embedded in the design project.
6. Help engineers understand how ergonomics helps control their legal liability as well as the gains offered by going beyond the legislative minimum.
7. Raise the profile of ‘workplace design’ and help establish company standards for workplace design criteria.
8. Introduce periodic ergonomic checks to create accountability and provide ‘feed-forward’ input to the design process.
9. Establish regular ergonomic feedback (on both successes and failures) for engineers.
10. Create organizational support for engineers when applying their ergonomics training.

expected and rewarded. Engage engineering managers in recognising and rewarding those engineers who are doing good human factors work.

5) Numerous stakeholders: Engineering projects have many stakeholders to consider – such as management, supervisors, customers, users and teams in charge of different technical aspects of the system – each of these with different goals and objectives. By attempting to meet the needs of all stakeholders, design solutions are further constrained.

Even in the most technical fields of engineering, design is a series of compromises. Engineers are not finding the best solutions as much as the most feasible solutions that will satisfy the majority of constraints – satisficing rather than optimizing. Work on getting ergonomics recognized by all stakeholders, particularly those with organizational power, to increase its status. Appeal to the strategic goals of each stakeholder group individually in order to show the various benefits of embedding ergonomics in their design requirements.

6) Engineers are highly accountable: Engineers may have legal liability in event of a lawsuit or accident.

Legislation can motivate engineers to include more human factors in their work and it may be effective to gently remind them of their liability. However, keep in mind that liability motivations may only ensure engineers work 'by the book' rather than out of a general understanding of the systemic benefits of human factors. Ergonomists can help engineers understand how ergonomics can limit their legal liability as well as the benefits of applying human factors beyond the minimum standard.

7) “Workplace design” is not managed: There appears to be a lack of recognition of “workplace design” as a specific process or activity within organizations; instead the focus usually surrounds “production system design.”

Workplace design is poorly managed and no one is personally responsible for ensuring all the pieces of a system will work together. Though someone may be held personally responsible in the event of a serious incident, a change in their behaviour is not likely to be enough to prevent the problem from reoccurring. The lack of specified 'workplace design' is usually built into a company's organizational structure; however ergonomists can work to increase awareness of how each system element contributes to a workplace. In addition to the recognition that workplaces are being designed, it may be valuable to facilitate the creation of workplace design criteria as a company standard.

8) No-“one” responsible for ergonomics: Workplace design is the result of many aggregated decisions made by various players and affected by policies at a wide level of organizational levels. The person who designs part of a system may have little control or responsibility for its management in the long-term and be unable to enforce ergonomic policies even if they support them. Responsibility for ergonomics is distributed among many parties and is therefore weakened for each individual.

Pay particular attention to the effects of system elements interacting to avoid any emergent problems that may be impossible to foresee when looking at different system components independently. Ergonomic checks should be integrated into the project management cycles (for example, at each 'stage gate') or at regular intervals to ensure human factors is not neglected. Such process controls can act as 'feed-forward' to guide design activities.

9) Engineers lack feedback: Designers do not receive long-term feedback about their designs. If a design can be implemented with no short-term problems, the designer may never know about the long-term implications of their work or take part in solution building should problems – in productivity, quality or user wellbeing – arise. There is a lack of organizational learning from mistakes and it is difficult for designers to improve their work over time. Designers who appear to be ignoring systemic problems may simply be so removed from that system in their daily work that they are unaware of the problem.

Try to get design engineers connected with their work by establishing formal feedback loops on ergonomics related measures. Resist the urge to focus only on the negative and provide positive feedback whenever progress in ergonomics is made.

10) Training alone is insufficient: Training engineers in ergonomics and creating awareness will not result in changed behaviour unless engineers are continually encouraged and supported to apply their knowledge in the workplace.

For training in ergonomics to be applied, the context of work must change to support it. Introduce organizational supports and create opportunities for demonstrating human factors knowledge. Examples might include changing sign-off procedures to include an ergonomics check, adding stage-gate requirements, adjusting management expectations, rewarding positive change, hiring new personnel who can support ergonomic activities, or introducing new tools and techniques to engineers.

CONCLUSION

Ergonomic change needs to be approached ergonomically. When introducing ergonomics to an organization, we are changing the jobs of engineers. Ergonomists must be sensitive to the work system surrounding design, removing barriers to ergonomics whenever possible and considering the abilities and limitations of those applying new methods and procedures. By gaining a better understanding of the competing demands placed on engineers, the organizational factors influencing engineering work, and the way health and safety issues are viewed from an engineer's perspective, it is our position that ergonomists can better support the uptake and application of ergonomics in engineering departments and throughout organizations.

For further elaboration on this topic by the authors of this paper, see:

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FURTHER READING

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