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Incorporating relevant usability factors into critical interactions

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Abstract

Enterprise applications are now emerging from nearly a decade-long drought of focus on user interaction and usability engineering. The causes of this period of neglect are numerous, and include: computation and connectivity values, information availability, throughput and performance improvements, the diminished value of high-level UI variations, and the alignment of usability engineering as a marketing component rather than a proponent of efficient business operations. The current Global User Experience is primed for a resurgence of focus on usability, particularly within the enterprise applications arena. The major drivers originally leading to neglect have now pivoted into drivers promoting the discipline. Computation and connectivity has grown beyond the ability of users to identify the scope and meaning of information available to them. Task performance improvements from digital computation have plateaued; further improvements require new human-related factors. Now all levels of the user interface architecture can be modified quickly and the wide variations in user interface interactions offer real business value though user interface design. The value of usability engineering as a partner to efficient business operations is becoming more evident as well. A pertinent area of focus is Critical Interactions. These are the steps in business processes where the important decisions are made, and where user actions critically affect task performance. Using relevant corollaries from safety-critical system design, the prime areas and methods for incorporating usability design, task analysis and user performance factors into enterprise application development are explained, with a focus on identifying critical interactions and improving the success rate of critical task completion.

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1. Introduction: Historical variation in usability expertise involvement

One of the most recognizable features of the early internet was the textual basis of information delivery. In the 1990's, most of the newly-created websites contained nothing but alphanumeric information, and the early internet forums, or "chat rooms" dominated the user experience. Indeed, since 1993, the very basis of most websites is HTML, a markup language designed primarily for textual displays.

While documentation, online or otherwise, can certainly benefit from usability design, in the late 20th century usability engineering was still a young discipline. As the graphical user interface developed and grew in complexity, usability design developed along with it. Soon benefits were seen from introducing usability concepts early and often throughout the product development lifecycle, and the term "usability engineering" was coined to describe the application of methods that improve a product's usability and user experience. Businesses joined in, supporting internal software teams with usability engineers to promote ease of use in their products for their own in-company users.

Usability engineering grew along with the World Wide Web during the "dot-com" era. As money flowed into new web-based business ventures, the focus on making products usable continued to strengthen. But usability wasn't the only benefactor of dot-com money. Extravagant marketing, expensive prototype designs and generous compensation packages were all fueled by the venture capitalism of the boom. However, as the dot-com bubble burst in the early 2000's, so with it went the mindset of engineering an application with a focus on the user. This occurred at a macro- level across the entire internet industry, and it was mirrored among the many dot-com as well as traditional companies. As stock prices tanked, funding and revenue vanished, and with it went any discipline that could be argued as being non-essential. Developers, analysts, or quality engineers were tasked with adding usability evaluations to their skillsets, and the discipline became diluted as a competitor to product development costs and schedule timeline concerns. Why would a focus on usability be one of the first product development disciplines to be marked as non-essential on a struggling balance sheet? There are several causes of this neglect of usability.

1.1. Computation and connectivity

First, the astonishing increase in computation and connectivity was able to drive value on its own. Particularly within the business enterprise environment, Moore's law continued to increase computing power, and the increasing speed of calculations was very evident. Spreadsheets that had taken hours to compile a few years earlier were completing in minutes, and as internet connection speeds continued to improve, users were getting and sharing more data, more quickly. It is sometimes hard to compare these early 21st century advances to similar increases in today's internet environment. While a doubling of connection speed today may, for example, reduce page-loading time from four to two seconds, this simply doesn't have the user impact of reducing file transfer times from many minutes to several seconds. In parallel the amount of information available electronically was growing geometrically, and new types of information sources spawned and individually populated. As the internet and World Wide Web grew, e-based communication applications grew; more information was available, whether a business user could extract it or not. It is important to note that within business enterprises, intranet communication speeds were most often magnitudes beyond nominal home users' speed, and the blindingly fast transfer of data across the enterprise eclipsed any concern about the usability of the data once it arrived at its destination.

1.2. Transition to digital

Second, this period was noted for shifting many traditionally paper-based activities into the electronic forum. Enterprise business tasks that had been completed on hand-written spreadsheets and transferred between responsible parties by hand were just beginning to be worked electronically. The idea of shared documentation and electronic files with multiple authors was seen a groundbreaking in comparison to the sequential editing processes of before.
The need to incorporate usability as a part of this transition was not truly considered, and if it was given any concern, it was reduced to a role of virtual mirroring; or designing the new electronic versions of office tasks to mimic the user experience of the traditional tasks as accurately as possible [1].

1.3. Establishment of imitative information architecture

Third, this era was noted for the establishment of widespread electronic information architecture. As user interfaces mimicked hardcopy forms, database design and structure was typically intended to replicate the organizational systems that it was replacing, and coupled with the communication and transfer improvements networking systems were offering, efforts to optimize the information architectures were not considered. Unfortunately, this leads to a mismatch in application data models and the user mental models. Early information architectures were heavily laden with the constraints inherent in their organizational protocols. This could be anything from string lengths, number of group members, size and type of data files, to early architect's personal preconceptions of unique organizational concepts. The likelihood that these early models actually captured an accurate vision of the users' mental model was rare. Any subsequent user interface improvements would have been made to higher, more visible layers in the architecture, and these improvements are diminished due to mismatches in the competing underlying structures. Rather than attempt to reorganize information architectures, system engineers and developers instead considered user interface improvements to be less valuable to the business than they could have been.

1.4. Organizational placement

Finally, the location of usability engineering within the enterprise organizational structure was often incorrectly managed. There are many shared responsibilities of commercial product usability design and product marketing; "voice of the customer" and Quality Function Deployment are two such shared activities[2]. The responsibility for these tasks traditionally falls to the Marketing area, and along with the task responsibility, the usability team that supports these efforts is brought within the fold. Unfortunately, this can constrain the goals of a usability team to marketing objectives, which are directed at consumers, rather than users, and rarely considerate of in-house enterprise teams themselves. The high-level goals of marketing, which include brand awareness, sales, and market share, do not transfer well to in-house enterprise application tools, and the value brought by usability engineering for enterprise applications, which leads to more effective and efficient business operations, is more often somewhat foreign to the marketing group.

2. Pivot: How usability impediments became drivers

Beginning in the 2010's, there has been resurgence in enterprise-level usability engineering. In part, this resurgence has followed the post-recession rebound and expansion of the tech economy, but there are other forces at work. The current Global User Experience is fostering a resurgence of focus on usability[3], particularly within the Enterprise applications arena. The major impediments that originally led to a reduction in usability engineering have now pivoted into drivers supporting it.

2.1. Computation and connectivity asymptote

Technological improvements have practical limits beyond Moore's law. For example, the visual resolution designed for digital cameras, document printers and flat screen displays up to one-meter-diagonal has surpassed the typical users' ability to notice further improvements. Likewise, computation and connectivity has grown beyond the ability of business users to benefit through process improvements solely based on retrieval speeds and data volumes. Quicker speeds and more voluminous amounts of data are not going to benefit them without an effective method of data parsing. Usability engineering can now move to the forefront of enterprise information display and design, to aid users in identifying important comparisons or unique values that suggest changing workflows. Today, lacking structured methods for intelligent and explanatory information displays will put users at risk for drowning in a virtual sea of data overload[4].

2.2. Digital improvements plateau

The digital office revolution has come, yet many things haven't changed. Business employees can routinely have over 100 individual business-related messages bombard them daily during the work week. Imagine the hardcopy analogy; a hundred separate memorandums or notes being received daily at your personal workspace. Clearly, digital composition and exchange of information has lightened the enterprise workers load, hasn't it? The reality is, we have reached a plateau in digitizing the workplace. Further digitizing of common office or enterprise business processes can now lead to additional confusion and complexity. Multiple forms are routinely used for storing the same information, because duplication of digital forms is easy. Keeping the forms in-synch with common information becomes the challenge. While we have used digital calendars to schedule meetings for nearly two decades, many enterprise workers are still reliant on wall calendars to easily view and comprehend the big picture on long-term projects and workflows. Computer-based architecture diagrams for systems, applications and processes are sometimes the most usable when they are printed out on blueprint-style sheets for collaborative review.

At this point, a different form of improvement needs to be added to the mantra of digitizing the workplace. Where can further improvements come from? Simply, we can improve the users' effectiveness and efficiency by applying usability principles and engineering to optimize user performance and satisfaction

2.3. Modifiable information architecture

The Enterprise development environment of the early 2000's included the expansion of object-oriented information architecture. At this relatively early stage in object-oriented development, a common tactic was to first replicate the existing structure of business architecture. This was done for reasons that include expediency in generating a workable model, assurance of model comprehensiveness, and a reduction in transition between existing and new models.

What this led to was the establishment of a duplicative foundational structure that was difficult to modify. However, as modeling systems and object-oriented software advanced, the ability to change all levels of the models, from foundational- to user-interface-levels, advanced within the tools. When all levels of the user interface architecture can be modified quickly, real benefits can be realized in user performance. As modeling tools advance, wide variations in user interface interactions can offer real business value though optimized user interface design.

2.4. Efficient business value

An informal maxim of marketing is, "Only 10% of advertising is successful, but nobody knows which 10% works." When usability design capabilities were kept within the marketing organization, they offered new ways to quantify products and software improvements through user satisfaction and product suitability, effectively identifying the product features that truly "worked". The organization was able to use usability research techniques to tease out the specific features that led to improvements in the products they sell. When Marketing started to present the value of usability, other business disciplines started to pay attention. As the previously mentioned plateaus in enterprise business performance have occurred, enterprise managers are now seeking the kind of results that Marketing has been claiming from usability engineering. Finally, the value of usability engineering as a partner to efficient business operations is becoming more evident.

3. Focus: Critical interactions

Now that usability engineering has regained a focus in the enterprise business area, it is important to establish the correct path for future growth of the discipline. How can usability engineering best be applied to enhance enterprise business workflows? Where are the areas of most-valuable-contribution for these applications? There are several models for involving usability engineering in product development lifecycles, but the specific user transactions on which to focus, the tasks that are most important to optimize for the user, are often undefined or unfortunately inaccurately defined. Ideally, the full breadth of the user experience is captured, analyzed and optimized for the best enterprise system improvement, however we must realistically admit that being able to involve usability engineering

from start to finish is a rare luxury in the enterprise business arena. While the resurgence of a usability focus is real and prominent, it is not yet widespread nor comprehensive, so it is important that it grow in the right direction, or risk another era of misunderstanding, where the pat answer of "We've tried usability; it doesn't help" again limits the impact the discipline can offer to business processes and user performance improvements.

The most pertinent area of focus may be on Critical Interactions. These are the steps in business processes where the important decisions are made, and where user actions critically affect task performance. Critical Interactions have been a focus in military, industrial and medical systems for many years (often termed "safety-critical") and much of the research in these areas can be leveraged to identify similar processes for design improvement and risk mitigation in enterprise operations.

3.1. Critical interaction examples

Traditionally, safety-critical tasks are defined as tasks that, if not completed correctly, could cause a major accident or unsafe situation[5]. A simple example would be an automobile driver's task of comprehending and responding to traffic light signals. When performed incorrectly, a driver risks injury to themselves and others.

It is not often immediately apparent how the concept of safety criticality would translate to the enterprise business environment. Most enterprise software applications or tasks do not seem to be capable of creating or promoting unsafe risks. However, upon further analysis, certain tasks coupled with specific situations can create a noticeable level of criticality. Often a somewhat mundane task quickly elevates in its "critical" nature dependent on the preceding and surrounding situation. For example time card entries and required in-house compliance training can elevate in criticality as the deadline for completing these tasks approaches. If there is only a minute left before your deadline to enter your weekly hours or quarterly training scores, the entry tasks must surely be performed quickly and flawlessly with no opportunity (due to no time) to cancel and re-enter the information.

Examples such as these demonstrate where a mundane and repetitive task can become critical in its performance based on the situation. From there it is not so far a stretch to identify tasks that have a more critical nature to them to begin with, and see how critical interactions often occur without notice, until a user performance error is made, and a failure is identified.

3.2. Critical interaction characteristics

What defines a Critical Interaction? How do we know one when we see one? There are common threads that characterize critical interactions. They include a task completion time constraint, and unforgiving user interface, a misleading or incorrect user model representation, complex training or operating instructions, and a task that can become more significant depending on the environment and situation. Within the Enterprise environment, this last characteristic, one of variability in a task's critical nature, is the most common. The majority of enterprise services are built around non-critical tasks that have an occasional timeframe constraint. These are the type of user interactions that are not regularly optimized for efficiency or utility, because they are by their nature the common, everyday tasks that are believed to not benefit very much from optimization. In most situations, this is correct, these tasks and user interactions are adequately designed to support the typical need. However, if available time limits shrink and deadlines suddenly loom, or the resulting risks of a failed task become greatly elevated, the completion of these tasks then become critical interactions, requiring an optimized user interface. It is these tasks (and the user experience that is offered to the task performers) that often become elevated to a critical level based on a change in the timeframe or failure effects, and users are forced to deal with a new critical situation via a non-optimized user experience.

3.3. Critical interaction analysis techniques

The guidance available through established safety-critical analyses can help us here. One of the techniques used to tease out critical tasks and risky situations in safety-critical systems is a process known as a Failure Mode and Effects Analysis (FMEA). There are variations of this task which include an assigned criticality level, analyses that focus on processes alone, and a specific variation that focuses on the human factors effects of tasks and

processes[6]. The benefits of this process include a quantifiable value that can be used to compare a level of risk between different processes. In addition to providing a baseline metric for future improvements, this value allows the analyst to prioritize their focus on reducing the highest-priority risks.

Other ways to focus on critical interactions come from the disaster recovery/business continuity arena. This discipline focuses on putting a plan in place to reduce business impact and recover critical enterprise systems following a disaster of any sort, and preventing self-induced disasters from occurring. This is a valuable philosophy to guide in the design of critical interactions, and highlights the value of a forgiving user interface. If errors can quickly be recovered from, there is far less of a chance that the situation will drive a critical interaction into a failure. While the specifics of data backup and recovery are often considered at an enterprise or system level in disaster recovery plans, the mindset of a user being able to recover from data loss, or miss-keyed entries, or to be able to roll back to a previous safe system state, are all helpful for user experience design, and reduces the possibility of critical interactions leading to failures as well.

The standard tenets of effective user interface design and usability engineering still hold for critical interactions. Task analysis, personas, and user performance factors each still have their place in effective design. Methods such as wireframing to develop an accurate information architecture and subsequent UI design, followed by effective user evaluations and design refinement, all help to create a more suitable user experience whether the interactions are critical or not.

What is different with critical interactions is the environment of the task; the true and elusive user experience of a rarely-instantiated situation that can transform a normal task into a critical one. If effective usability factors are not identified and used to optimize these interfaces, critical interactions will continue to dominate in their impact to enterprise systems and the true causes of these hindrances will remain hidden and undefined, behind a wall of existing architecture, design and inertia. With usability engineering once again expanding its inclusion within enterprise application development, critical interactions can now be identified and optimized to lead to safer, more productive systems.

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