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Economic Value of User Interface Design

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ECONOMIC VALUE OF USER INTERFACE DESIGN: MEASUREMENT, ANALYSIS AND IMPLEMENTATION

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Abstract

The economic value of well-designed user interfaces (UI) and user experiences (UX) is challenging to quantify, a topic that the current literature does not sufficiently explore. Those responsible for deciding whether to invest resources in UI/UX typically base these decisions on monetary considerations. The link between effective UI/UX design and profit may not be immediately clear to most, yet it is universally acknowledged that satisfied customers lead to successful business. To underscore the importance of investing in UI/UX, it is crucial to define the relationship between effective design and economic success in a way that can be understood by designers, engineers and CEOs alike.

Keywords: UI/UX, user interfaces, design, economics, user experience, design investment

Introduction

User interface design is the process of creating a mode of communicating and interacting with the user. While this process may have various goals in mind (e.g., simplicity, efficiency, profit), there is always a purpose and intent behind every user interface. User interface design is not always intuitive, and decades of research have sought to understand what makes certain interfaces more effective than others. This more creative type of engineering is not widely understood in terms of economic value. By defining the specific results of well-designed interfaces and identifying the profit drivers associated with them, we can better explain the monetary value of UI/UX investment. The following associations will be expanded upon in this analysis:

User Interface Design Outcomes	**Corresponding Profit Driver**
User Experience	Customer Retention
Brand Recognition	Consumer Security and Higher Conversion Rates
Intuitive Flows	Decreased Customer Support Cost
Productivity	Satisfactory Customer Reviews and Impressions

Basic Design Architecture	Less Tech Debt and Future Redesign Cost
Differentiation and Innovation Perception	Market Competitiveness

Effective User Interface Design

While the goal of this analysis is not to describe effective design principles, a brief overview of what constitutes “good” design will help to explain later concepts. The most basic and widely accepted standards of UI design were outlined by Ben Shneiderman in his book "Designing the User Interface: Strategies for Effective Human-Computer Interaction". He offers a list of 8 “golden rules” that have withstood nearly 40 years of changing technology.

1. Strive for consistency

   Effective user interfaces utilize consistency to reduce the cognitive load on users. If the “continue” button is always green and in the lower right corner of the screen, users can easily determine how to proceed, even when encountering an unfamiliar page.

2. Enable frequent users to use shortcuts

   Any interface will have users with varying levels of skill and experience. A first-time user and an experienced user will be using the same interface, so

it is important to keep both of them in mind during design. Keeping the interface clear and simple for the first-time user can be achieved while also adding in hidden shortcuts or quick links inside of a drop down menu for the experienced users.

3. Offer informative feedback

   Providing informative feedback is essential for boosting users' confidence. The emphasis here is on 'informative.' Error messages that provide only numeric codes or vague information do not assist the user.

4. Design dialogue to yield closure

   Dialogue is a form of feedback that can also be used to increase a user's confidence. For example, when submitting a form or confirming a purchase, a "Thank You!" or success message informs users that their action has been successful and prevents them from wondering if there is a next step.

5. Offer simple error handling

   When errors inevitably occur, clear instructions on how to resolve them are critical. Instead of a general error message, provide specific guidance like "Prohibited character in Name field" so that users can quickly rectify their mistake.

6. Permit easy reversal of actions

   Making it clear that actions are not final, but can be changed, increases the user's confidence. If they are afraid of making a mistake, they may stop in

their tracks and leave the page to try and make sure that they are completing their task correctly. Allowing users to easily go back and change things lets them feel free to continue in the flow that was originally intended by the designer.

7. Support an internal locus of control

   Allow users to be fully in control of their experience. When navigating an interface, users want to have an idea of what link or button will take them to which page. Allowing easy reversal of actions supports the internal locus of control.

8. Reduce short-term memory load

   Interfaces should principally focus on ease of use. Information organization is an entire sub-category of user interface design that strives to find the easiest way for users to find the information they need within a large set. Reducing the pressure on users can be done through displaying their page history, allowing users to pick from a list of choices rather than write short answers, or implementing a back button instead of a home-page redirect.

When an interface is designed using principles such as these, it will greatly improve the experience of the user. Many of these principles may seem obvious, but the goals of engineers and designers are often in conflict. If left up to an engineer, the interface may be designed in a way that focuses on integration with the codebase. Software architecture

and visual design architecture are highly independent. For example, the best error message for an engineer would be a technical description along with a file path and line number. This information would only confuse a non-technical user. An engineer may resent the need to spend extra time creating editable fields and back buttons on every page. However, these features are expected by the typical user. Their absence can lead to confusion. In essence, the goals of engineering and design do not always align. Well-designed user interfaces empower non-technical users to interact with and navigate software with ease.

User Experience

If user interfaces are the visual components used to communicate with users, the user experience can be defined as the sentiment and efficacy a user encounters while interacting with that interface. Assuming that an interface is designed according to UI/UX standards described in the previous section, a positive user experience is likely to follow. Indicators of a positive user experience include successful completion of tasks, easy navigation with minimal backtracking, few errors, and favorable sentiment from users. Researchers Andara and Rachmawati conducted a study to demonstrate the direct influence of positive user experience on customer loyalty. They analyzed survey responses from 385 phone operators in Indonesia and found that user experience accounted for 56.6% of customer loyalty. This experience was measured in several individual components: functionality, trustworthiness, perceived service quality, and

monetary value to the user. All of these components must be conveyed to the user through the interface. In a 2016 study titled “The Six Steps For Justifying Better UX”, Forrester Research found that a well-designed UX could result in an incredible 400% increase in a website’s conversion rate. Hence, a well-designed interface not only increases conversion rates but also contributes significantly to the retention of a firm’s customer base, underlining its economic value.

Brand Recognition

Though often associated solely with marketing, brand recognition also significantly depends on well-designed interfaces. Take into account elements like the website's header and footer, the navigation bar, and even the color scheme. If these elements were to change abruptly from one page to the next, it could undermine users' confidence about being on the correct site. For instance, imagine opening Netflix in a web browser, only to find the page loaded with a white background and shows arranged in columns instead of rows. Such an unexpected change could lead you to question the authenticity of the site. This example illustrates the impact of UI elements on consumer security and confidence. Consistency is one of the most widely agreed-upon principles of UI design, and maintaining it can bolster users' confidence, thereby enhancing their loyalty and conversion rates.

Intuitive Flows

Flows, a common term in UI design, are the navigational paths that users take to complete tasks. For example, if a user wanted to update their profile photo, they might need to follow a flow like this: Menu Icon -> Settings Tab -> My Account -> Change Profile Photo. When these flows follow UI design standards and are organized in a way that users can understand, it not only increases the productivity of the user but also significantly decreases the amount of resources a firm might spend on customer support. To conclude with an example:

"A certain printer manufacturer released a printer driver that many users had difficulty installing. Over 50,000 users called support for assistance, at a cost to the company of nearly $500,000 a month. To correct the situation, the manufacturer sent out letters of apology and patch diskettes (at a cost of $3 each) to users; they ended up spending $900,000 on the problem. No user testing of the driver was conducted before its release. The problem could have been identified and corrected at a fraction of the cost if the product had been subjected to even the simplest of usability testing" (Mauro, 1994, p. 129).

Productivity

Well-designed interfaces can increase user productivity by allowing the completion of a greater number of tasks in a shorter time span. Conversely, an interface lacking in design quality might necessitate additional navigation time, thereby generating

user frustration. Even if tasks are eventually completed successfully, a user may end up with a negative regard of an interface after encountering multiple points of confusion or error. UI/UX design is heavily focused on increasing productivity through intuitive flows, information organization, and accessibility. Users who feel productive are more likely to continue using a product or service and leave positive reviews. The perceived value of a service can be heavily dependent on its interface, for example: Zillow could have detailed listings of every home on the market, but if users aren't able to find what they are looking for easily, the entire service loses its worth. Thus, it becomes evident that an interface's design quality is crucial not only for user satisfaction but also for the sustained success and reputation of the product or service.

Basic Design Architecture

Like software, when an interface is planned thoughtfully, it is easily modified and scaled. Investing in UI design at the start of a project means creating a library of design elements that can facilitate additional features easily. In addition, a well-planned interface prevents usability problems and reduces customer support costs as discussed earlier. When usability is an afterthought, costly redesigns and piles of user complaints follow. "The rule of thumb in many usability-aware organizations is that the cost benefit ratio for usability is $1 : $10–$100. Once a system is in development, correcting a problem costs 10 times as much as fixing the same problem in design. If the system has been released, it

costs 100 times as much relative to fixing in design" (Gilb, 1988). However, fixing usability problems later in development can still reap benefits:

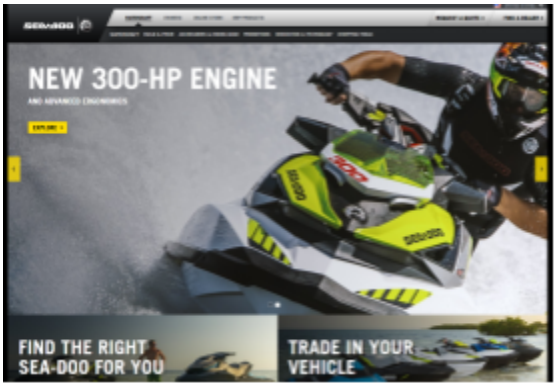
"The average user interface has some 40 flaws [note: this figure is presumably based primarily on client-server software applications, as opposed to Web sites; typical Web sites might have even more flaws considering the large number of sites constructed by developers with little usability training]. Correcting the easiest 20 of these yields an average improvement in usability of 50%. The big win, however, occurs when usability is factored in from the beginning. This can yield efficiency improvements of over 700%" (Landauer, 1995).

In short, when UI design is included in the development process, future problems are prevented. The return on investment is visible in several examples, even if that investment occurs down the line.

Differentiation and Innovation Perception

Investment in UI design can lead to a beautiful and modern interface. A combination of unique layout, inventive navigation, and elegantly displayed information can create a memorable experience that increases retention as well as conversion. In addition, two specific products of a well-designed interface contribute to positive sentiment from users: differentiation and innovation perception. Differentiation is the idea that, while one service may offer similar features to other services, a unique design can separate the service from its competitors. There may be dozens of streaming sites, but

what sets them apart might be the scope of media offered, unique features, or a seamless interface that never frustrates users. Innovation perception is created when an interface is recognized by users to be modern, technologically advanced, or even futuristic. Consider the following home pages from Sea-Doo, a personal watercraft brand.



Sea-Doo 2016 Home Page

Sea-Doo 2023 Home Page

The first home page, from July of 2016, features text-heavy navigation, unaligned links, and generally looks difficult to navigate. In the redesign, Sea-Doo uses a totally unique left-aligned navigation bar, a complete update in terms of colors and branding, and even incorporates interactive buttons that show a fun wave animation when the user hovers their mouse over them. These memorable attributes of the Sea-Doo website undoubtedly create a lasting impact on users, giving Sea-Doo an edge against its competitors. Sea-Doo also differentiates itself from the typical sporting gear or vehicle brand by leaning into a fun and playful design, leaving behind the dark and sleek feeling in the 2016 version. Sea-Doo smartly markets itself as a family brand with fun for all ages, and this is reflected in the interface.

Conclusion

In a world that is increasingly digitized, the design of the user interface is a key determinant of a product's success. Despite this, it is often undervalued or misunderstood. It is essential to educate both the software engineering community and business stakeholders about the importance of investing in UI design and the economic benefits it can bring. By doing so, we can ensure that our digital products are not just functional, but also a pleasure to use, thereby driving customer satisfaction and business success.

In conclusion, user interface design is a critical aspect of software development that significantly impacts a product's economic value. Its implications span across various aspects of a product's performance, from user experience and brand recognition to customer support costs and market competitiveness. Therefore, understanding and investing in user interface design is a strategic decision that can provide a significant return on investment.

Bibliography

Aaron Marcus. "User Interface Design's Return on Investment: Examples and Statistics." Cost-Justifying Usability. 2nd ed., edited by Randolph G. Bias and Deborah J. Mayhew, Morgan Kaufmann, 2005, pp. 17-39. https://doi.org/10.1016/B978-012095811-5/50002-X.

Andara, Agung and Rachmawati, Indira. “The Effect Of Corporate Image On User Experience And Customer Loyalty Relationship: A Study of GSM Operators in Indonesia.” e-Proceeding of Management: Vol.4, No.2, 2017, pp. 1746-1752.

Gilb, T. "Principles of Software Engineering Management." Usability Is Good Business, 1988, www.compuware.com. Accessed 1 May 2023.

Hogan, A. "The Six Steps For Justifying Better UX." Forrester, 2016, www.forrester.com/report/The-Six-Steps-For-Justifying-Better-UX/RES117708.

Landauer, T. K. The Trouble with Computers: Usefulness, Usability, and Productivity. MIT Press, 1995.

Mauro, C. "Cost-justifying Usability in a Contractor Company." Cost-Justifying Usability, edited by R. G. Bias and D. J. Mayhew, Academic Press, 1994, pp. 123-142.

Shneiderman, Ben, et al. Designing the User Interface: Strategies for Effective Human-Computer Interaction. 6th ed., Pearson, 2016.