Assignment 2: "Humans and Design Guidelines" Report

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Resumen— **It is indisputable that humans are a key part of the "human-computer" equation of "human-computer interaction" and as such, it is imperative to take into account psychological principles that affect usage of UIs and how they relate to design guidelines in a bid to achieve better UIs/UX.**

Palabras clave— **human-computer interaction, psychological principles, design guidelines.**

I. Psychological Principles

When designing a product, it is of paramount importance to have an explicit idea about the type of response you would like to elicit from your users. Having a clear comprehension of psychology principles goes a long way to influencing human behavior and ensuring a more seamless user experience for the target market.

According to the paper by Claus-Christian Carbon on "Psychology of Design" [1] and an article by Taylor Green [2] on psychology principles for UI design, the following psychological principles for user interface can be gleaned:

1. ***Hick's Law***: The basic idea of this states that, the time it takes to make a decision increases with the number and complexity of choices.
   Albeit perceived as the most straightforward principle, this is arguably the most important one. Too many options on a menu, for instance, would most likely result in indecision on the part of the user.
   This can be averted by chunking or abstracting the functionalities into sub-menus. For instance, a UI for a music app organising the tracks into genres and the tracks in the genres being organised by artists or period of release.
   However, the designer should still be careful to avoid having too many chunks or else we would end up in square one.
2. ***Cognitive Law***: In UI/UX design this refers to the mental investment required by the average user to operate the user interface.
   Often, designers operate under the grave assumption that the users are as conversant as they are; usually making the judgement that some functionalities are "common sense".
   Since one cannot exactly eliminate cognitive load, the designer ought to eliminate extraneous cognitive load i.e., that which requires substantial mental investment but does not assist the user to understand the content of the UI.
   We can avert extraneous cognitive load by avoiding clutter, removing redundant links and playing on users' transference of knowledge and experiences with other UIs build to perform the same function to reduce the amount if "thinking" they need to do.
3. ***von Restorff Effect***: Also known as The Isolation Effect, predicts that when multiple similar objects are present, the one that differs from the rest is most likely to be remembered.
   For instance, if the UI is presenting the users with some payment/subscription plans, it is advisable to have the moderately priced plan at the center of the page and preferably in a distinct color.
   In a paper by Bo Johansson [6] on attention and the von Restorff effect, isolated items on a UI do have an effect on how they are recalled; the items measured included but were not limited to positioning of the item and the presentation mode. To this latter point, a UI that has interactive audio visual presentations e.g., the use of breif, minimalist but catchy previews on auto-play as soon as the user reaches the part of the screen/UI in question such as the one employed on the Apple website to draw the users' attention to newly released and (albeit comparatively) reasonably priced devices is likely to have more success than a UI that simply lists their products in "monotone".

II. Design Guidelines

In this section, we will discuss the design principles that stem from consideration of human factors as a key part of the interaction equation. We will further explore some research work that has been done to support the investment in understanding humans as machine users.

The following design guidelines have been derived from the writings mentioned herein:

1. ***Physical ergonomics***: this refers to the body's responses to physical work demands. For instance, using the hand muscles to hold your smartphone or interact with a screen via touch a screen. Proper ergonomic design is necessary to create comfortable interaction with a product.
   There is a trade-off between having the desired functionality readily presented onto the interface and ergonomics. Take the case of a web page or an application with a "back" button to take the user to the previous page. Depend-

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ing on the target market, the placement of this button on the UI may interfere with or impede efficient physical interaction with the UI/device. If you place it to the extreme bottom right, it may be ergonomically disadvantageous for left-handed users and vice versa. One must therefore find the correct balance for such a situation.

One way to solve this would be to implement rapid prototyping; get as many test versions out to users in as many demographics as possible and implement the aggregate of their feedback in order to arrive at a compromise that optimises profits and UX. A paper by Yoann Gabillon et. al. [3] uses a case study of a travel agency's software with different UI designs for each window to exploit various levels of ergonomics. The paper further elaborates measurement of ergonomics based on different criteria, most notably information density; i.e., if the UI has more information displayed, the user is likely to require more physical investment in interaction, etc.

From all these, the designers need to take into account specific operations that the user is going to perform (e.g., entering text into a web form), physical characteristics of the device (weight, size and shape of the TV remote control, for instance) and the target context of use of the device.

The inspiration for this guideline can be drawn from the von Restorff effect discussed in the section on psychological principles. if the physical ergonomics i.e., the screen size of the target devices of the UI being developed, are taken into account, we are more likely to take optimum advantage of attention and isolation of products that have the right balance of being affordable for the user while giving the seller (taking into consideration the example elaborated under "von Restorff effect" in the preceding section) a healthy profit.

In a general sense, the UI ought to isolate/distinguish key functionality enough to catch the users eye; for this to work while optimising the available physical resources, the designer ought to take into account the ergonomics of the target device.

Guideline 1: *Functionality requiring expenditure of physical resources should be designed in a way to ensure fairness for all users. For instance, a scrolling functionality that utilises gestures on a touchscreen device should allow the user to perform the scrolling from any part of the screen and not just the right, for example.*

2. ***Consistency***: The main idea here is to ensure that there is minimal deviation in how the interface in question looks and works throughout the interaction chain.

   This design principle can be further split into two as:

   - Internal consistency; The same design conventions ought to be applied throughout the product's UI. This could be down to the color scheme used or aspects as high level as ensuring that an action or set of actions, X, provides an action or set of reactions, Y, throughout the UI/s in the product.

     We shall consider the case of Ms Word in this scenario. The CTRL+X, CTRL+C, CTRL+V shortcuts (actions) result in the same cut-copy-paste (reactions) functionalities all throughout Ms Word.
   - External consistency; Use the same design conventions across all platforms for the product, such as desktop, mobile, and so on.

     Again, taking the case of Ms Word, the core of the UI design from aspects as trivial as the color scheme and placement of buttons and menus on the interface to key functionality such as shortcuts; is maintained across several OSs (taking difference in operating systems as a benchmark platform) from Windows to MacOS to iOS and iPadOS in order to achieve external consistency.

   A paper by Anton Axelsonn [4] on consistency in web design from a user perspective also delves into further classification of consistency in terms of perception, semantics and procedure. As the title of the paper suggests, these play more on the user's cognition that on the designer's point of view but are just as important. Their definitions are, however, interwoven. For example, procedural consistency would ensure that a specific set of actions produces a specific set of reactions throughout the UI, in line with the principle of internal consistency discussed under this point; while perceptual consistency is to do with the product maintaining a uniform physical (that which is perceived) design throughout the product as discussed under the internal consistency point. Semantic consistency plays on the user's conceptual model of the how the UI works i.e., when a system is semantically consistent it facilitates the user's conceptual model.

   Additionally, a consistent UI is guaranteed to have a higher learn-ability score. This ties into the psychological principle dealing with the cognitive load of the users. A product with consistent design requires lower mental investment while using it across different platforms/devices because most of the actions are transferable.

   Guideline 2: *The UI's design should maintain internal consistency and predictability. The (default) color scheme, on-screen button arrangement as well as repetitive functions (such as navigation, printing, saving) that may have keyboard functionality should be maintained throughout the interface. For the latter, it should not be the case that different keyboard combinations perform the same functionality for the same interface; even worse if the combinations in question perform other functionality*

as well thus causing an overlap. For external consistency, the interface should also maintain physical/aesthetic design as well as access to functionality offered. For instance, it should not be the case that a key combination that performs function, say X, on one platform performs function, say Y, for the same interface on another platform; where functions X and Y are different functions.

3. ***Sense of control***: The goal of UI design is control of information by the user. The user is the one who should control the interaction with a system, not the other way around.
   As per an article by Nick Babic [5] at Adobe; a company whose success has been built on provision of across-the-board document handling software with good usability scores, it is imperative that the UI provides adequate feedback for operations performed by the user, control of system operations (provision for the ability to interrupt or terminate actions) and personalization (provision for the system's adaptability to the user's needs and/or preferences).
   The above can be seen as practical implementations of flexibility (where the system enables/allows users with different levels of expertise to customise the product however they see fit), robustness (provision of error handling techniques and further support for determining successful achievement and assessment of goal-directed behaviour).
   Though it may seem far-fetched, we could argue that this design principle ties into the psychological principle/s discussed under Hick's Law. A product that enables the user to have an optimum amount of control over the software is likely to allow the user to choose how they would like their menus and/or options organised in a way that neither overwhelms them nor takes away from the array of options available. Here, we would be playing on the subjectivity of a UI being "overwhelming"; some users like to be presented with as much information as possible while some do not.
   Taking the case of the music app alluded to in the preceding section, if the app allows the user to select the criteria under which they wish the music tracks to be grouped before they can navigate and choose, this would be far more ideal as compared to a UI that has predefined criteria for this process.
   Guideline 3: *For menus that allow clustering of choices and options availed, the clustering criteria can be selected by the user but a limit of up to 7 sub-clusters for each cluster to be maintained for purposes of memory load balancing while navigating.*

Referencias

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