

## General Principles of User Interface Design and Websites

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### Abstract

User Interfaces have gone a major transformation since 1970s, all this was possible because of the advances in HCI and related technologies. The Principles of User Interface design has contributed much to the change that we see in the present day user interfaces and predominantly the web interfaces of various websites. This paper presents the various General Principles of User Interface Design and their relevance for present day web interfaces with full length analysis. Each principle is investigated over five different types of web interfaces with 30 different websites per type. The various properties that contribute to the principles have been investigated thoroughly and their statistical values are reported in their entirety.

**Keywords:** Aesthetics, Clarity, Consistency, HCI, User Interface.

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### 1. INTRODUCTION

The ability to design user interface so that it attracts the users attention and enhances the user experience is always a challenge that the UI designers face. In this continuous race to develop attractive user interfaces comes the help of the user interface principles to a great extent. It has been argued that the general user interface guidelines regain slight modifications that are specific to a system for effective results [1]. With the rapid growth in the use of web has resulted in discovering the fact that simple web presence does not guarantee attracting visitors to an organization website [2].

The esthetics of the user interface is the predominant factor in gaining the users attention and laurels. Careful application of esthetic concepts can aid acceptability and learnability [3]. In a research [3] by David Chek Ling Ngo., et al. esthetic measures have been investigated [and successfully published] by taking 14 important characteristics, namely, balance, equilibrium, symmetry, sequence, cohesion, unity, proportion, simplicity, density, regularity, economy, homogeneity, rhythm, order and complexity [3]. California Digital Library (CDL) follows a set of user interface principles when selecting information services vendors on behalf of the entire university of California [4].

This paper presents various principles of user interface design that are general and also reports about these general principles as such their extent of presence in the modern web user

interfaces. The data and values presented here are obtained during a case study explained in section 2 of this paper.

## 2. CASE STUDY

The study has been carried out by students of Human Computer Interaction course, in the final semester of four year under graduation program. Students have been distributed among 30 batches; each batch consisting of minimum of 4 students and maximum of 5 students.

The investigative form of study has been carried out over five categories of web user interfaces, namely,

- a) Social network website interfaces
- b) Job site interfaces
- c) Shopping website interfaces
- d) Stock trading website interfaces
- e) E-mail interfaces.

The student batches were given forms consisting of user interface principles, properties, characteristics that need to be investigated over the respective website interfaces, and asked to fill them accordingly. The student batches have selected over 150 different popular websites that come under these five different categories. Each batch will investigate one web user interface per category, making 30 web interfaces per category for all batches. The duration for the study carried out was around 3 months. Every batch worked for minimum 3 hours per week in the college laboratory, investigating various user interface aspects of their selected web interfaces. The investigative form of study by the HCI students brought interesting and broad details about various user interface properties, characteristics, principles. We present all these in detail in the following sections of this paper.

## 3. GENERAL PRINCIPLES

The design goals in creating a user interface are described below. They are fundamental to the design and implementation of all effective interfaces, including GUI and Web ones. These principles are general characteristics of the interface, and they apply to all aspects. They are derived from the various principles described in [5], [6, 7], [8], [9, 10, 11], [12], and [13].

### 3.1 Aesthetically Pleasing

A design aesthetic, or visually pleasing composition, is attractive to the eye. It draws attention subliminally, conveying a message clearly and quickly [14]. Visual appeal is provided by following the presentation and graphic design principles to be discussed, including providing meaningful contrast between screen elements, creating spatial groupings, aligning screen elements, providing three-dimensional representation, and using color and graphics effectively. Good design combines power, functionality, and simplicity with a pleasing appearance [14]. The graph shown in figure1 shows the percentages of pleasing felt by the users.



FIGURE 1: Aesthetically Pleasing

In *Social Networking interfaces*, 26% of overall aesthetics is contributed by providing meaningful contrast between screen elements, 24% by proper grouping of elements, 24% by the proper alignment of screen elements and groups, 3% by three dimensional representation and 22% by

effective and simple usage of colors and graphics. The Aesthetically pleasing property was at **75.2%** for all the investigated Social Network web interfaces. In *Online Shopping website interfaces*, 26% of overall aesthetics is contributed by providing meaningful contrast between screen elements, 25% by proper grouping of elements, 22% by the proper alignment of screen elements and groups, 7% by three dimensional representation and 19% by effective and simple usage of colors and graphics. The Aesthetically pleasing property was at **76.2%** for all the investigated Shopping website interfaces.

As of *Job site interfaces*, 27% of overall aesthetics is contributed by providing meaningful contrast between screen elements, 28% by proper grouping of elements, 24% by the proper alignment of screen elements and groups, 1% by three dimensional representation and 20% by effective and simple usage of colors and graphics. The Aesthetically pleasing property was at **71.8%** for all the investigated Job site interfaces. In *Stock trading website interfaces*, 26% of overall aesthetics is contributed by providing meaningful contrast between screen elements, 23% by proper grouping of elements, 21% by the proper alignment of screen elements and groups, 9% by three dimensional representation and 21% by effective and simple usage of colors and graphics. The Aesthetically pleasing property was at **71.2%** for all the investigated Stock trading website interfaces.

With *E-mailing interfaces*, 26% of overall aesthetics is contributed by providing meaningful contrast between screen elements, 24% by proper grouping of elements, 24% by the proper alignment of screen elements and groups, 2% by three dimensional representation and 24% by effective and simple usage of colors and graphics. The Aesthetically pleasing property was at **71.8%** for all the investigated Stock trading website interfaces.

### 3.2 Clarity

The interface must be clear in visual appearance, concept, and wording. Visual elements should be understandable, relating to the user's real-world concepts and functions. Metaphors, or analogies, should be realistic and simple. Interface words and text should be simple, unambiguous, and free of computer jargon [14]. The graph in figure 2 represents percentage of clarity felt by the user in different types of web interfaces.



FIGURE 2: Clarity

With the interfaces of *Social networking sites*, 26% of overall clarity is contributed by visual appearance, concepts & clear wording, 22% by visual elements understandable in relation to the user's real-world concepts and functions, 20% by simple interface words and text, 15% by unambiguous text and wording, 17% by words free of computer jargon. The overall clarity stood at **74.4%** for this category of web interfaces. For the interfaces of *Online Shopping websites*, 26% of overall clarity is contributed by visual appearance, concepts & clear wording, 24% by visual elements understandable in relation to the user's real-world concepts and functions, 24% by simple interface words and text, 9% by unambiguous text and wording, 17% by words free of computer jargon. The overall clarity stood at **78.2%** for this category of web interfaces.

For the interfaces of *Job sites*, 26% of overall clarity is contributed by visual appearance, concepts & clear wording, 26% by visual elements understandable in relation to the user's real-

world concepts and functions, 27% by simple interface words and text, 9% by unambiguous text and wording, 12% by words free of computer jargon. The overall clarity stood at **74.2%** for this category of web interfaces. For the interfaces of *Stock trading websites*, 25% of overall clarity is contributed by visual appearance, concepts & clear wording, 22% by visual elements understandable in relation to the user's real-world concepts and functions, 22% by simple interface words and text, 16% by unambiguous text and wording, 14% by words free of computer jargon. The overall clarity stood at **74%** for this category of web interfaces.

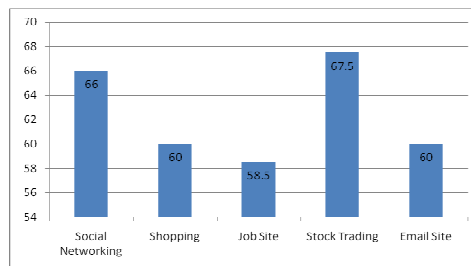
Coming to *E-mailing websites*, 26% of overall clarity is contributed by visual appearance, concepts & clear wording, 21% by visual elements understandable in relation to the user's real-world concepts and functions, 25% by simple interface words and text, 13% by unambiguous text and wording, 15% by words free of computer jargon. The overall clarity stood at **73.4%** for this category of web interfaces.

### 3.3 Compatibility

The aspects of compatibility that have been investigated are [14]:

- a) User compatibility, b) Tasks and job compatibility, c) Product compatibility.

The graph in figure 3 depicts user's understanding of compatibility among various web user interfaces.



**FIGURE 3:** Compatibility

For user interfaces of *Social Network sites*, 64% of overall compatibility is contributed by the functions/tasks provided in the user interface, that are related to the work user wanted to perform, 36% by the user feel towards the screen and the way it is structured. The students felt compatibility is only up to **66%** in all the investigated user interfaces of this category. For user interfaces of *Online Shopping sites*, 72% of overall compatibility is contributed by the functions/tasks provided in the user interface, that are related to the work user wanted to perform, 28% by the user feel towards the screen and the way it is structured. The students felt compatibility is only up to **60%** in all the investigated user interfaces of this category.

With the user interfaces of *Job sites*, 78% of overall compatibility is contributed by the functions/tasks provided in the user interface, that are related to the work user wanted to perform, 22% by the user feel towards the screen and the way it is structured. The students felt compatibility is only up to **58.5%** in all the investigated user interfaces of this category. For user interfaces of *Stock trade sites*, 65% of overall compatibility is contributed by the functions/tasks provided in the user interface, that are related to the work user wanted to perform, 35% by the user feel towards the screen and the way it is structured. The students felt compatibility is only up to **67.5%** in all the investigated user interfaces of this category.

In the user interfaces of *E-mailing web sites*, 71% of overall compatibility is contributed by the functions/tasks provided in the user interface, that are related to the work user wanted to perform, 29% by the user feel towards the screen and the way it is structured. The students felt compatibility is only up to **60%** in all the investigated user interfaces of this category.

### 3.4 Comprehensibility

A system should be understandable, flowing in a comprehensible and meaningful order. Strong clues to the operation of objects should be presented. The steps to complete a task should be obvious. Reading and digesting long explanations should never be necessary [14]. The graph in figure 4 depicts various levels of comprehensibility felt by the users in the 5 different web user interfaces investigated.



**FIGURE 4:** Comprehensibility

In *Social Network sites*, for the user interfaces, 49% of overall comprehensibility is contributed by the screen and it's elements that are understandable & meaningful, 51% by providing strong clues while doing operations or tasks, 0% by long explanations. The overall comprehensibility stood at **57.3%** for this category web interfaces. In *Online Shopping web sites*, for the user interfaces, 46% of overall comprehensibility is contributed by the screen and it's elements that are understandable & meaningful, 40% by providing strong clues while doing operations or tasks, 14% by long explanations. The overall comprehensibility stood at **70.3%** for this category web interfaces.

In *Job sites*, for the user interfaces, 48% of overall comprehensibility is contributed by the screen and it's elements that are understandable & meaningful, 36% by providing strong clues while doing operations or tasks, 16% by long explanations. The overall comprehensibility stood at **62.3%** for this category web interfaces. In *Stock trade web sites*, for the user interfaces, 43% of overall comprehensibility is contributed by the screen and it's elements that are understandable & meaningful, 41% by providing strong clues while doing operations or tasks, 16% by long explanations. The overall comprehensibility stood at **71%** for this category web interfaces.

In *E-mailing web sites*, for the user interfaces, 52% of overall comprehensibility is contributed by the screen and it's elements that are understandable & meaningful, 35% by providing strong clues while doing operations or tasks, 13% by long explanations. The overall comprehensibility stood at **59%** for this category web interfaces.

### 3.5 Configurability

Easy personalization and customization through configuration and reconfiguration of a system enhances a sense of control, encourages an active role in understanding, and allows for personal preferences and differences in experience levels. It also leads to higher user satisfaction [14]. Some people will prefer to personalize a system to better meet their preferences. Other people will not, accepting what is given. Still others will experiment with reconfiguration and then give up, running out of patience or time. For these latter groups of users a good default configuration must be provided [14]. The graph in figure 5 shows configurability levels among different web interfaces.



**FIGURE 5:** Configurability

For *Social network user interfaces*, 58% of overall configurability is contributed by the availability of customization, 42% by the availability of personalization. The overall configurability stood at **62%** for this category web interfaces. For *Online shopping user interfaces*, 63% of overall configurability is contributed by the availability of customization, 37% by the availability of personalization. The overall configurability stood at **35%** for this category web interfaces in the study. For *Job user interfaces*, 52% of overall configurability is contributed by the availability of customization, 48% by the availability of personalization. The overall configurability stood at **48%** for this category web interfaces. For *Stock trade user interfaces*, 57% of overall configurability is contributed by the availability of customization, 43% by the availability of personalization. The overall configurability stood at **50%** for this category web interfaces. For *E-mailing user interfaces*, 49% of overall configurability is contributed by the availability of customization, 51% by the availability of personalization. The overall configurability stood at **73.5%** for this category web interfaces.

### 3.6 Consistency

Consistency as said by Galitz [14] can be achieved by:

A system should look, act, and operate the same throughout. Similar components should:

- Have a similar look.
- Have similar uses.
- operate similarly.
- The same action should always yield the same result.
- The function of elements should not change.
- The position of standard elements should not change.

Design consistency is the common thread that runs throughout these guidelines. It is the cardinal rule of all design activities. Consistency is important because it can reduce requirements for human learning by allowing skills learned in one situation to be transferred to another like it. The graph in the figure 6 depicts consistency levels for various types of web user interfaces investigated.



**FIGURE 6:** Consistency



When studying the concept of consistency in *Social network web interfaces*, 32% of overall consistency is contributed by the similar components having similar look, 26% by similar components having similar uses, 29% by same actions producing same result in different times/pages/sections, 13% by changing standard elements positions. The overall consistency stood at **56.75%** for this category of web user interfaces. When studying the concept of consistency in *Online Shopping web interfaces*, 29% of overall consistency is contributed by the similar components having similar look, 25% by similar components having similar uses, 33% by same actions producing same result in different times/pages/sections, 13% by changing standard elements positions. The overall consistency stood at **58.25%** for this category of web user interfaces.

When studying the concept of consistency in *Job web interfaces*, 35% of overall consistency is contributed by the similar components having similar look, 19% by similar components having similar uses, 24% by same actions producing same result in different times/pages/sections, 22% by changing standard elements positions. The overall consistency stood at **48.25%** for this category of web user interfaces. When studying the concept of consistency in *Stock trade web interfaces*, 30% of overall consistency is contributed by the similar components having similar look, 24% by similar components having similar uses, 34% by same actions producing same result in different times/pages/sections, 12% by changing standard elements positions. The overall consistency stood at **54.25%** for this category of web user interfaces.

In *E-mailing web interfaces*, 27% of overall consistency is contributed by the similar components having similar look, 24% by similar components having similar uses, 37% by same actions producing same result in different times/pages/sections, 12% by changing standard elements positions. The overall consistency stood at **59.5%** for this category of web user interfaces.

### 3.7 Control

Control is feeling in charge, feeling that the system is responding to your actions. Feeling that a machine is controlling you is demoralizing and frustrating. The interface should present a tool-like appearance. Control is achieved when a person, working at his or her own pace, is able to determine what to do, how to do it, and then is easily able to get it done [14]. The graph in the figure 7 shows levels of control felt by the users among various web user interfaces.

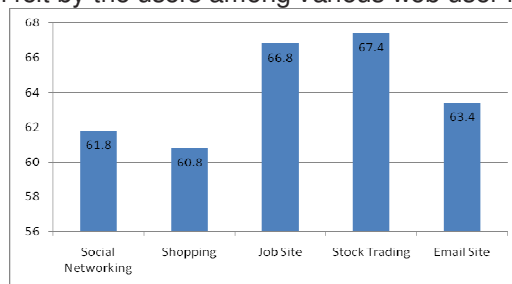


FIGURE 7: Control

With the user interface of *Social network web sites*, 26% of overall control is contributed by the property that actions are carried out only on user requests, 26% by actions that are performed quickly, 14% by the availability interruptions or terminations for the actions being carried out, 14% by the interruptions due to errors, 20% by the availability of different modes of interaction. The overall control stood at **61.8%** for this category web user interfaces. For the user interface of *Online Shopping web sites*, 28% of overall control is contributed by the property that actions are carried out only on user requests, 26% by actions that are performed quickly, 22% by the availability interruptions or terminations for the actions being carried out, 9% by the interruptions due to errors, 15% by the availability of different modes of interaction. The overall control stood at **60.8%** for this category web user interfaces.

For *Job web sites*, 29% of overall control is contributed by the property that actions are carried out only on user requests, 25% by actions that are performed quickly, 17% by the availability interruptions or terminations for the actions being carried out, 16% by the interruptions due to errors, 13% by the availability of different modes of interaction. The overall control stood at **66.8%** for this category web user interfaces. For the user interface of *Stock trade web sites*, 27% of overall control is contributed by the property that actions are carried out only on user requests, 27% by actions that are performed quickly, 17% by the availability interruptions or terminations for the actions being carried out, 14% by the interruptions due to errors, 15% by the availability of different modes of interaction. The overall control stood at **67.4%** for this category web user interfaces.

Coming *E-mailing web sites*, 30% of overall control is contributed by the property that actions are carried out only on user requests, 27% by actions that are performed quickly, 20% by the availability interruptions or terminations for the actions being carried out, 13% by the interruptions due to errors, 10% by the availability of different modes of interaction. The overall control stood at **63.4%** for this category web user interfaces.

### 3.8 Directness

Tasks should be performed directly. Available alternatives should be visible, reducing the user's mental workload. Directness is also best provided by the object-action sequence of direct manipulation systems. Tasks are performed by directly selecting an object, then selecting an action to be performed, and then seeing the action being performed [14]. The graph in the figure8 shows the levels of directness felt by the users for different web user interfaces.



**FIGURE 8:** Directness

For the user interfaces of *Social network sites*, 29% of overall directness is achieved by making alternative actions visible, 34% by providing immediate effect/result of the actions performed on objects, 37% by providing tasks that can be performed directly. The overall directness stood at **82.6%** for this category of sites. For the user interfaces of *Online shopping web sites*, 27% of overall directness is achieved by making alternative actions visible, 37% by providing immediate effect/result of the actions performed on objects, 36% by providing tasks that can be performed directly. The overall directness stood at **86.3%** for this category of sites.

With the user interfaces of *Job sites*, 28% of overall directness is achieved by making alternative actions visible, 37% by providing immediate effect/result of the actions performed on objects, 35% by providing tasks that can be performed directly. The overall directness stood at **73.6%** for this category of sites. For the user interfaces of *Stock trade sites*, 27% of overall directness is achieved by making alternative actions visible, 37% by providing immediate effect/result of the actions performed on objects, 36% by providing tasks that can be performed directly. The overall directness stood at **81%** for this category of sites.

For *E-mailing sites*, 21% of overall directness is achieved by making alternative actions visible, 40% by providing immediate effect/result of the actions performed on objects, 39% by providing tasks that can be performed directly. The overall directness stood at **73%** for this category of sites.



### 3.9 Efficiency

Eye and hand movements must not be wasted. One's attention must be captured by relevant elements of the screen when needed. Sequential eye movements between screen elements should be predictable, obvious, and short. Web pages must be easily scannable. All navigation paths should be as short as possible [14]. Avoid frequent transitions between input devices such as the keyboard and mouse [14]. The graph in figure 9 shows the users perception of efficiency among different web user interfaces.

In the user interfaces of *Social network sites*, 31% of overall efficiency is contributed by making eye & hand movements between the controls/components easy, 17% by short navigation paths, 23% by providing sequential eye movement through the screen and 28% by frequent transition between input devices. The overall efficiency stood at **64%** for this type of user interfaces. In the user interfaces of *Online shopping sites*, 30% of overall efficiency is contributed by making eye & hand movements between the controls/components easy, 17% by short navigation paths, 26% by providing sequential eye movement through the screen and 27% by frequent transition between input devices. The overall efficiency stood at **67.25%** for this type of user interfaces.



FIGURE 9: Efficiency

For the user interfaces of *Job sites*, 32% of overall efficiency is contributed by making eye & hand movements between the controls/components easy, 14% by short navigation paths, 24% by providing sequential eye movement through the screen and 30% by frequent transition between input devices. The overall efficiency stood at **72.25%** for this type of user interfaces. In the user interfaces of *Stock trade sites*, 31% of overall efficiency is contributed by making eye & hand movements between the controls/components easy, 18% by short navigation paths, 23% by providing sequential eye movement through the screen and 28% by frequent transition between input devices. The overall efficiency stood at **66.25%** for this type of user interfaces.

With the *E-mailing sites*, 31% of overall efficiency is contributed by making eye & hand movements between the controls/components easy, 11% by short navigation paths, 29% by providing sequential eye movement through the screen and 29% by frequent transition between input devices. The overall efficiency stood at **69.25%** for this type of user interfaces.

### 3.10 Familiarity

Familiarity as said by Galitz [14] can be achieved by:

- Employing familiar concepts and using language that is familiar to the user.
- Keeping the interface natural, mimicking the user's behavior patterns.
- Using real-world metaphors.

The graph in the figure 10 shows familiarity levels perceived by the users in different web interfaces.

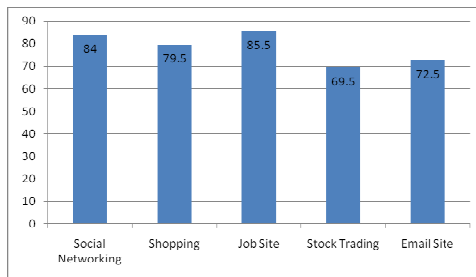


FIGURE 10: Familiarity

For the user interfaces of *Social network sites*, 55% of overall familiarity is contributed by providing a language known to the user, 45% by making interface look like real-world situation. The overall familiarity stood at **84%** for this type of user interfaces. For the user interfaces of *Online shopping sites*, 51% of overall familiarity is contributed by providing a language known to the user, 49% by making interface look like real-world situation. The overall familiarity stood at **79.5%** for this type of user interfaces.

Coming to *Job sites*, 56% of overall familiarity is contributed by providing a language known to the user, 44% by making interface look like real-world situation. The overall familiarity stood at **85.5%**. For the user interfaces of *Stock trade sites*, 44% of overall familiarity is contributed by providing a language known to the user, 56% by making interface look like real-world situation. The overall familiarity stood at **69.5%** for this type of user interfaces.

In *E-mailing sites*, 56% of overall familiarity is contributed by providing a language known to the user, 44% by making interface look like real-world situation. The overall familiarity stood at **72.5%** for this type of user interfaces.

### 3.11 Flexibility

Flexibility is the system’s ability to respond to individual differences in people. Permit people to choose the method of interaction that is most appropriate to their situation. It is also accomplished through permitting system customization [14]. The graph in the figure 11 shows flexibility levels perceived by the users in different web interfaces.

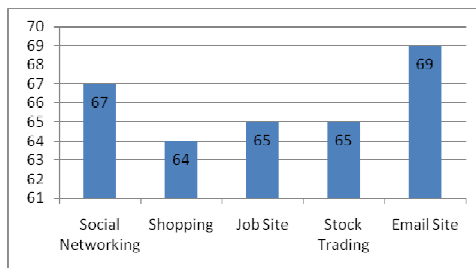


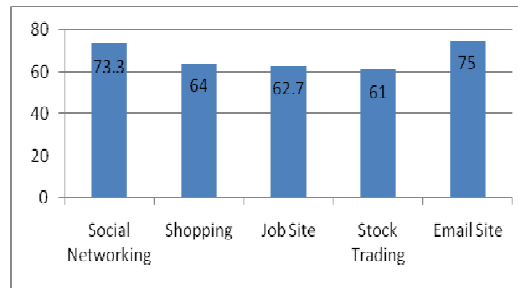
FIGURE 11: Flexibility

For the user interfaces of social network sites, **67%** felt that system is flexible enough when personalizing for their preferences. In stock trading sites, the flexibility stood at **65%**. For the user interfaces of online shopping sites, the flexibility felt is around **64%**. For the user interfaces of job site the flexibility stood at **65%** and for the e-mail site it was around **69%**.

### 3.12 Forgiveness

People will make mistakes; a system should tolerate those that are common and unavoidable. A forgiving system keeps people out of trouble [14]. People like to explore and learn by trial and error. A system oversensitive to erroneous inputs will discourage users from exploring and trying new things [14].

Prevent errors from occurring by anticipating where mistakes may occur and designing to prevent them. Permit people to review, change, and undo actions whenever necessary. Make it very difficult to perform actions that can have tragic results. When errors do occur, present clear instructions on how to correct them [14]. The graph in the figure 12 shows various levels of forgiveness felt by the users.



**FIGURE 12:** Forgiveness

In the user interfaces of *Social network sites*, 38% of overall forgiveness is contributed by system helping the user to correct when he/she makes error, 22% by preventing user from making errors, 40% by providing constructive messages when error is occurred. The overall forgiveness stood at **73.3%** for this type of user interfaces. In the user interfaces of *Online shopping sites*, 37% of overall forgiveness is contributed by system helping the user to correct when he/she makes error, 25% by preventing user from making errors, 38% by providing constructive messages when error is occurred. The overall forgiveness stood at **64%** for this type of user interfaces.

As of *Job sites*, 38% of overall forgiveness is contributed by system helping the user to correct when he/she makes error, 22% by preventing user from making errors, 40% by providing constructive messages when error is occurred. The overall forgiveness stood at **62.66%** for this type of user interfaces. In the user interfaces of *Stock trade sites*, 38% of overall forgiveness is contributed by system helping the user to correct when he/she makes error, 22% by preventing user from making errors, 40% by providing constructive messages when error is occurred. The overall forgiveness stood at **61%** for this type of user interfaces.

In the user interfaces of *E-mailing sites*, 36% of overall forgiveness is contributed by system helping the user to correct when he/she makes error, 25% by preventing user from making errors, 39% by providing constructive messages when error is occurred. The overall forgiveness stood at **75%** for this type of user interfaces.

### 3.13 Predictability

Anticipation, or predictability, reduces mistakes and enables tasks to be completed more quickly. All expectations possessed by the user should be fulfilled uniformly and completely [14]. The graph in the figure 13 shows various levels of predictability felt by the users.



**FIGURE 13:** Predictability

For the user interfaces of *Social network web sites*, 51% of overall predictability is contributed by the property that the user's expected result is matching to the actual result of actions, 49% by providing results of the actions uniformly and completely. The overall predictability stood at **90%** for this category web site interfaces. For the user interfaces of *Online shopping web sites*, 46% of overall predictability is contributed by the property that the user's expected result is matching to the actual result of actions, 54% by providing results of the actions uniformly and completely. The overall predictability stood at **88.5%** for this category web site interfaces.

As of *Job web sites*, 46% of overall predictability is contributed by the property that the user's expected result is matching to the actual result of actions, 54% by providing results of the actions uniformly and completely. The overall predictability stood at **81.5%** for this category web site interfaces. For the user interfaces of *Stock trade web sites*, 49% of overall predictability is contributed by the property that the user's expected result is matching to the actual result of actions, 51% by providing results of the actions uniformly and completely. The overall predictability stood at **89%** for this category web site interfaces.

In the user interfaces of *E-mailing web sites*, 50% of overall predictability is contributed by the property that the user's expected result is matching to the actual result of actions, 50% by providing results of the actions uniformly and completely. The overall predictability stood at **92%** for this category web site interfaces.

### 3.14 Recovery

Recovery should be obvious, automatic, easy and natural to perform. Easy recovery from an action greatly facilitates learning by trial and error, and exploration [14]. The graph in the figure 14 shows various levels of recovery felt by the users.



FIGURE 14: Recovery

In the user interfaces of *Social network web sites*, 46% of overall recovery is contributed by the 'redo' of actions users have just done, 54% by providing the option to go back to the previous action when user stuck in moving forward or doing next action. The overall recovery stood at **65.5%** for this type of web user interfaces. In the user interfaces of *Shopping web sites*, 43% of overall recovery is contributed by the 'redo' of actions users have just done, 57% by providing the option to go back to the previous action when user stuck in moving forward or doing next action. The overall recovery stood at **74%** for this type of web user interfaces.

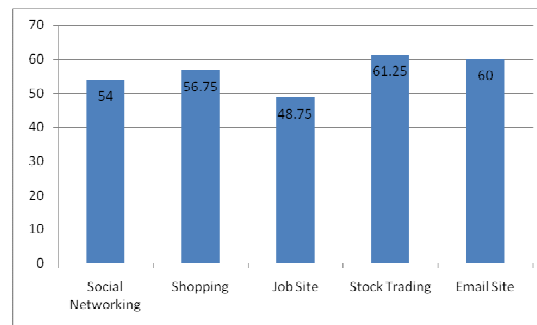
Coming to the user interfaces of *Job web sites*, 46% of overall recovery is contributed by the 'redo' of actions users have just done, 54% by providing the option to go back to the previous action when user stuck in moving forward or doing next action. The overall recovery stood at **54%** for this type of web user interfaces. In the user interfaces of *Stock trade web sites*, 35% of overall recovery is contributed by the 'redo' of actions users have just done, 65% by providing the option to go back to the previous action when user stuck in moving forward or doing next action. The overall recovery stood at **43.5%** for this type of web user interfaces.

For *E-mail web sites*, 36% of overall recovery is contributed by the 'redo' of actions users have just done, 64% by providing the option to go back to the previous action when user stuck in

moving forward or doing next action. The overall recovery stood at **69%** for this type of web user interfaces.

### 3.15 Responsiveness

A user request must be responded quickly. Feedback may be visual, the change in the shape of the mouse pointer, or textual, taking the form of a message. It may also be auditory, consisting of a unique sound or tone [14].



**FIGURE 15:** Responsiveness

For the user interfaces of *Social network websites*, 35% of overall responsiveness is contributed by system rapidly responding to user's request/actions, 24% by providing feedback/acknowledgement of user actions through VISUAL clue, 39% by providing feedback through TEXTUAL clues and only 2% by providing feedback through AUDIO clue. The overall responsiveness stood at **54%** for this category of web user interfaces. For the user interfaces of *Shopping websites*, 34% of overall responsiveness is contributed by system rapidly responding to user's request/actions, 20% by providing feedback/acknowledgement of user actions through VISUAL clue, 37% by providing feedback through TEXTUAL clues and only 9% by providing feedback through AUDIO clue. The overall responsiveness stood at **56.75%** for this category of web user interfaces.

In *Job websites*, 38% of overall responsiveness is contributed by system rapidly responding to user's request/actions, 15% by providing feedback/ acknowledgement of user actions through VISUAL clue, 43% by providing feedback through TEXTUAL clues and only 4% by providing feedback through AUDIO clue. The overall responsiveness stood at **48.75%** for this category of web user interfaces. For the user interfaces of *Stock trade websites*, 30% of overall responsiveness is contributed by system rapidly responding to user's request/actions, 25% by providing feedback/acknowledgement of user actions through VISUAL clue, 35% by providing feedback through TEXTUAL clues and only 10% by providing feedback through AUDIO clue. The overall responsiveness stood at **61.25%** for this category of web user interfaces.

With *E-mailing websites*, 32% of overall responsiveness is contributed by system rapidly responding to user's request/actions, 24% by providing feedback/acknowledgement of user actions through VISUAL clue, 38% by providing feedback through TEXTUAL clues and only 6% by providing feedback through AUDIO clue. The overall responsiveness stood at **60%** for this category of web user interfaces.

### 3.16 Simplicity

Provide as simple an interface as possible.

■ Five ways to provide simplicity [14]:

- Use progressive disclosure, hiding things until they are needed.
  - Present common and necessary functions first.
  - Prominently feature important functions.
  - Hide more sophisticated and less frequently used functions.
- Provide defaults.

- Minimize screen alignment points.
- Make common actions simple at the expense of uncommon actions being made harder.
- Provide uniformity and consistency.



**FIGURE 16:** Simplicity

In the user interfaces of *Social network websites* studied, 23% of overall simplicity contributed by providing common and prominent features/functions at the first sight, 21% by making sophisticated and less frequently used features/functions to hide or can be accessed by performing interaction, 16% by providing defaults, 23% by making common actions simple and 17% by uniformity & consistency of the screen items and interactions. The overall simplicity stood at **70%** for this type of web user interfaces.

For *Online shopping websites* studied, 23% of overall simplicity contributed by providing common and prominent features/functions at the first sight, 19% by making sophisticated and less frequently used features/functions to hide or can be accessed by performing interaction, 16% by providing defaults, 23% by making common actions simple and 19% by uniformity & consistency of the screen items and interactions. The overall simplicity stood at **81.2%** for this type of web user interfaces.

Coming to *Job websites* studied, 20% of overall simplicity contributed by providing common and prominent features/functions at the first sight, 18% by making sophisticated and less frequently used features/functions to hide or can be accessed by performing interaction, 20% by providing defaults, 24% by making common actions simple and 18% by uniformity & consistency of the screen items and interactions. The overall simplicity stood at **76.4%** for this type of web user interfaces.

As of *Stock trading websites* studied, 20% of overall simplicity contributed by providing common and prominent features/functions at the first sight, 22% by making sophisticated and less frequently used features/functions to hide or can be accessed by performing interaction, 14% by providing defaults, 21% by making common actions simple and 23% by uniformity & consistency of the screen items and interactions. The overall simplicity stood at **78.4%** for this type of web user interfaces.

The user interfaces of *E-mailing websites* studied, 24% of overall simplicity contributed by providing common and prominent features/functions at the first sight, 17% by making sophisticated and less frequently used features/functions to hide or can be accessed by performing interaction, 17% by providing defaults, 23% by making common actions simple and 19% by uniformity & consistency of the screen items and interactions. The overall simplicity stood at **73.6%** for this type of web user interfaces.

### 3.17 Groupings

Grouping screen elements aids in establishing structure, meaningful relationships & meaningful form. In addition to providing aesthetic appeal, Past research has found that grouping aids in information recall and results in a faster screen search. The study by Grose, Parush, Nadir, and



Shtub found that providing groupings of screen elements containing meaningful group titles was also related to shorter screen search times [14].

The grouping principle stood at 74.6% for Social network web user interfaces, 77% in stock trading web interfaces, 74% in E-mailing interfaces, 76% in online shopping web interfaces and 77% in job site interfaces.

### 3.18 Grouping Using White Space

Galitz [14] suggests to provide adequate separation between groupings through liberal use of white space and also asks to carefully consider the trade-off between screen white space and the requirement for page scrolling.

Grouping with white spaces was at 17% in social network website interfaces, 16% in stock trading site interfaces, 16% in E-mailing user interfaces, 16% in online shopping user interfaces, and 21% is in jobsite interfaces.

### 3.19 Grouping Using Borders

When grouping with borders, Galitz [14] asks to (a) incorporate line borders for: (i) Focusing attention on groupings or related information. (ii) Guiding the eye through a screen.

(b) Not exceed three line thicknesses or two line styles on a screen. (c) Create lines consistent in height and length. (d) Leave sufficient padding space between the information and the surrounding borders. (e) For adjacent groupings with borders, whenever possible, align the borders left, right, top, and bottom. (f) Use rules and borders sparingly.

In Web page design: (i) Be cautious in using horizontal lines as separators between page sections. (ii) Reserve horizontal lines for situations in which the difference between adjacent areas must be emphasized.

Grouping with borders was at 24% in social network web interfaces, 19% in stock trading web interfaces, 24% in E-mailing web interfaces, 24% in online shopping user interfaces and 16% in job site interfaces.

### 3.20 Focus and Emphasis

Galitz [14], recommends to apply a visual emphasis technique to highlight the most important or prominent parts of a screen. An emphasized element should contrast with the rest of the screen, calling the user's eyes to it.

To provide emphasis, various techniques such as [14]: (a) Higher brightness (b) Reverse polarity or inverse video (c) Larger and distinctive font (d) Underlining (e) Blinking (f) Line rulings and surrounding boxes or frames (g) Contrasting color (h) Larger size (i) Positioning, (j) Isolation (k) Distinctive or unusual shape (l) White space can be used in a systematic and pleasing fashion.

The values in Table 1 shows different emphasis techniques and their instances among various web interfaces investigated.

Focus/Emphasis Techniques	Social network sites	Stock trading sites	E-mail sites	Online Shopping sites	Job sites
Higher brightness	79	84	80	80	80
Reverse polarity	42	74	35	53	35
Larger & distinctive font	84	89	70	100	100
Underlining	32	47	60	50	40
Blinking	32	37	15	45	20
Contrasting color	89	89	80	84	75
Unusual shapes for important elements	32	53	45	40	40

TABLE1: Focus and Emphasis

#### 4. CONCLUSION

The user interface principles stands good even after many years of their introduction. The only difference is that they take different forms with core aspects of the principles standing strong. This has made the websites studied popular even with low values for some of the principles investigated. The study has revealed the existence of these principles in various forms and the importance of their existence for a user interface to be attractive and efficient. The vast list of statistics reported in this paper helps to understand the principles' individual presence in different type of web interfaces and also the popularity of those user interfaces among the users.

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