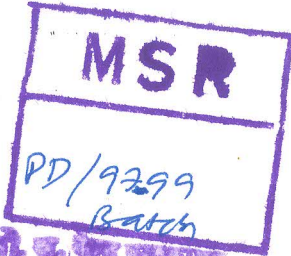




Icons and its variability in graphical user interface

By
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Guide
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Approval sheet

This is to certify that "icons and its variability in graphical user interface" a special project has been submitted by Imtiyaz Khatib (97613804) as a part of academic projects, in the partial fulfillment of M.Des program at Industrial Design Center, Indian institute of Technology Bombay.

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N. Sam

Examiner :

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Imtiyaz khatib

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abstract

Visualization of system status and of ongoing process has enhanced user understanding, a user interaction with CAD application holds its essence in how the system is easily perceived via its graphical user interface. An attempt is made to gain first hand information about variability and usability of icons, contextual to its application, the objective of the study was to investigate the factors that constitutes user percievement about icons and its relational aspect.

The methodology adopted was based on comprehending the underlying concepts of GUI in CAD software's, analyzing and evaluating icons which were selected from various contexts viz. Visualization, drafting, analysis and modeling. The icons were tested for critical evaluation amongst designers, graphic visualizers, users of the same software's, architects, engineers etc. To understand their perception about variability.

Ch.1 **Introduction**

User interface design (UI)

A user interface is the communication medium between user and product. Its the point at which functions translate into functionality adjustments translate into ajustability, products translate into productivity. Interface aid users achieving their goals after all if its not designed with the user in mind, how good it can be? Because computer systems increasingly interact with users via graphic user interfaces, a successful interface has become an essential element influencing the usefulness of a computer application.

Graphical User interface design (GUI)

User interfaces are the clothing worn by applications or operating systems to make it more interactive. A Microsoft and group bull report found both beginners (48% more productive) and experienced users (58% more productive) worked faster and made fewer mistakes with a GUI rather than text based interface. The beauty of GUIs is that they can convey much more information on the screen, text displays have space for 24 lines of 80m characters each whereas GUIs can theoretically turn every point on the screen into information, atypical display comprises of 780,000 bits of data and with color the potential is even more. The incorporation of GUI in application development changes the whole cycle of software design, it is vital to know the" users perception" of what the application is doing for them and what would make it easier to work with.

GUIs require a good principle of graphic design sense, an awareness of layout, color texture, imagery, signs, icons, symbols and animation. Designers have to get out of the "storytelling approach" and into non-linear sequencing, thus allowing greater flexibility. Effective GUI design is accomplished through consistent and clear presentation of the graphical elements in an interactive application. The application design also needs to be conceptually simple and clear. This involves designing menus and graphical elements with visual and textual clarity. The user understands its functionality and enjoys using

it. This is accomplished when the design process is developed with the user at heart. In order to meet the user's needs, the application needs to be easy to learn and interactively intuitive. Good interface design fulfills these requirements by applying the following principles:

- Consistency
- Clarity
- Interactive Communication

The first hurdle for the user is learning how to use the application. One of the key principles in Graphical User Interface (GUI) design is aimed at making this learning process as painless as possible. Its goal is to create visual and functional consistency within the application, across applications and with objects from the "real world". The potential of applications can therefore be fully realized after applying following standards in defining windows, dialogs, menus, and graphical control elements. These Helps users learn how to use the application quickly and implement it for effective and efficient output

Ch.2
Interface development

History of interface development

interfaces	History of development
Keyboard-based menus	Earlier than 1978, probably quite ancient
Keyboard-based hierarchical menus	UCSD's Pascal system (1978) or earlier
Bitmapped displays	CSL@Xerox PARC, for the Alto(?). PERQ was first commercial product (or Terak Corporation, c. 1978)
BitBLT raster operations	Dan Ingalls(LRG)@Xerox PARC
Light pen as screen pointer	1960 or earlier
Joysticks	Spacewar games, 1962 or earlier
Trackballs	Some time in 1960s
Pointing device with on-screen pointer	Doug Englebart@SRI (mid 70s).
Mouse	Doug Englebart@SRI (trackball upside down?)

interface	History of development
Cursor changes to show context	David Tilbrook (Newswhale) (1975)
Menus Popup Menus	LRG@Xerox PARC (?) Ingalls(LRG)@Xerox PARC
Pulldown menus	Lisa@Apple
Menu bar	Lisa@Apple
Hierarchical menus	Paeth(SSL)@Xerox PARC (Smalltalk)
Command keys for menu items	Lisa@Apple or Ed Anson (1980) or earlier
Check marks on menu items	Lisa@Apple
Overlapped windows	Ingalls(LRG)@Xerox PARC
Tiled windows	CSL@Xerox PARC
Event queues	Simula@NCC, then Lisa@Apple or Ed Anson(GPGS) -> CORE, GKS (1975)

interface	History of development
Icons	David Smith(SDD)@Xerox (Star->Mac->Lisa)
Scroll bars	LRG@Xerox PARC
Push Buttons	LRG@Xerox PARC
Radio Buttons	Kaehler(LRG)@Xerox PARC
Check Boxes	LRG@Xerox PARC (?)
Dimming of inactive buttons	David Tilbrook (Newswhale) (1975)
Dialog Boxes	Star@Xerox PARC (property sheets)
Concept of resources	Horn(Mac)@Apple
Multiple fonts & styles in text	CSL@Xerox PARC (Bravo) or Wang word processors (1978 or earlier)
Modeless Interaction	Tesler(SSL)@Xerox PARC
Move/Copy/Delete	Xerox PARC

Interface	History of development
Selection point between characters	Tesler(SSL)@Xerox PARC (Gypsy & Smalltalk). TECO had this earlier than PARC, it is claimed;
Cut/Copy/Paste with a mouse	Tesler(SSL)@Xerox PARC (Gypsy, Smalltalk)
Disabling of menu items	Lisa@Apple or Ed Anson (1980 or earlier) or Xerox PARC (1982 or earlier)

Ch.3. Graphical user interface system

GUI Elements of software application

The main component of a graphical user interface is the window. There are two types of windows viz.

- Application Window
- Dialog Box

Application Window

The central framework, which contains the main functions of the application, resides in the application window. This is the window, which will appear when the application is started. Some important elements, which form the application window, are the following:

Buttons

A rectangular graphic that is usually labeled with text to indicate its function. Buttons usually perform an instantaneous action to initiate or conclude a process.

Check boxes

Used when alternatives are not mutually exclusive, or may be applied simultaneously, such as type styles: type can be both bold and italic at the same time. Check boxes never initiate or conclude an action, they are only used to set choices.

Cursors (or pointers)

An extremely important but often overlooked component of graphic interfaces. Cursors indicate the point of action or insertion on the screen, often acting as a virtual manipulator or hand tool for moving and editing on-screen objects. Cursors are often used to indicate the state of the system (watch or hourglass cursors indicate a

short pause, for example), or change to indicate a change in the interactive possibilities offered by the interface (like the window resize arrow cursors that appear at the edges of windows in the Microsoft Windows interface).

Default buttons

A screen button with a heavy outline used to indicate the most likely action to be taken (as long as there is no danger that the action will result in the loss of the user's data). Default buttons are usually linked to the Return key of the keyboard; to initiate the default action the user can just hit the Return key. Special windows that pop up to provide information or choices to the user. Dialog boxes are usually modal, that is, they must be dismissed (with the "Cancel" or "OK" buttons) before further action can take place. Some dialog boxes provide many buttons, pop-up menus, or other choices; others may just contain a text message with an "OK" button used to dismiss the dialog box.

Pop-up menus

Often used in dialog boxes to provide a list of mutually exclusive choices; a more compact choice than listing the items as radio buttons.

Pull-down menus

Menus that drop down from the menu bar at the top of the screen (Mac interface) or top of the window (Windows interface). Menu selection usually initiates some action directly. Menu items that open a dialog box for further information are indicated by placing an ellipsis after the item name (for example, "Print..." opens a dialog box that solicits further information before printing actually takes place). Dividers are used to logically group menu items, or may simply provide visual relief in long menus. Submenus (such as the "Modify submenu shown at the left) are a means of multiplying the number of menu items available. However, multiple submenus, or triple-layered submenus require too much dexterity for most users and most interface guidelines discourage nested submenus.

Radio buttons

Denote mutually exclusive choices. Radio buttons are used in situations where only one setting can be active at a time. The name is derived from the metaphor of car radio buttons, where only one radio station can be selected at a time. Radio buttons never initiate or conclude an action; they are only used to set choices.

Window styles

All interfaces provide a number of standard window styles. Window styles also incorporate standard interface elements such as scroll bars, close boxes, pop-up menus, and "zoom boxes."

Cascading

Cascading menus, or sometimes-called hierarchical menus, are sub-menus of the pull-down menus. It is usually placed to the right side of the pull-down menu. It is activated by a right pointed triangle next to the menu item name. The only time a cascading menu is recommended is when it simplifies a pull-down menu that has too many menu items. It has disadvantages however since this causes difficulty when trying to get to a certain command which has been buried deep under sub-menus. In general, avoid using cascading menus unless absolutely necessary.

Icons

Objects and actions are depicted on screens through pictograms or symbols called icons. They form the most essential element of GUI and holds importance in terms of its effectiveness and ease in understanding and use.

Ch.4.
design guidelines

principles of user interface design

The principle of user profiling
Knowing the user

The principle of metaphor
Borrow behaviors from systems familiar to your users.

The principle of feature exposure
Let the user see clearly what functions are available

The principle of coherence
The behavior of the program should be internally and externally consistent

The principle of state visualization
Changes in behavior should be reflected in the appearance of the program

The principle of shortcuts
Provide both concrete and abstract ways of getting a task done

The principle of focus
Some aspects of the UI attract attention more than others do

The principle of grammar
A user interface is a kind of language -- know what the rules are

The principle of help
Understand the different kinds of help a user needs

The principle of context
Limit user activity to one well-defined context unless there's a good reason not to

Graphic user interface design guidelines

GUI design is an area whose scope is broad and varied ranging from work in typography and the graphic arts, semiotics, technical writing, human factors, programming, informational wayfinding and cognitive psychology.

- Determine the essential qualities that should be conveyed by the design. This is typically a short list of adjectives. Also identify any fixed, formal elements - such as a texture, pattern, color, or label - that applies to all icons in the set.
- Critically examine each element in the design. Ask yourself why it is needed, how it relates to the essence of the design (identified in the previous step), and how the design would suffer without it. If you can't answer any of these questions, remove the element.
- Try to remove the element from the design, anyway. What happens? If the design collapses either functionally or aesthetically, the element must be included. Otherwise, consider omitting it from the final solution.
- Analyze the verbal contents and the display environment. Determine how icon parts and complete icons should relate. Icons are often developed in a chaotic manner with elements that may not be relevant, consistent, or useful. Too many parts may confuse the viewer.
- Design the initial icons by creating quick sketches. Once the semantic content has been organized, create many quick sketches that may vary from logical abstractions to concrete images. Indicate all visual elements, their approximate size, and their approximate location. It is important not to be too precise or

detailed early in the design process. It is more important to explore possible variations. Evaluate which icons seem to meet the needs of the sender, the receiver, the message, and the medium.

- Sort the icons into styles. Consistent stylistic treatment has a major effect on the perceived complexity of icons. Styles should be established, in which all the icons are grouped by consistent approach or appearance (for example, curved versus angular shapes). By sorting the sketches, it is easier to keep track of tradeoffs in optimizing the entire set of icons with respect to simplicity, clarity, and consistency.
- Design a layout grid that organizes all major elements of the icons. Determine an underlying spatial grid to make consistent all visual components, including point elements, gray patterns, curves, angles, the length and width of rules, etc. It is especially
- objects and actions. Shneiderman (1987) suggests that simple metaphors, analogies, or models with a minimal set of concepts are the best places to start in developing icons. He also suggests that mixing metaphors from two or more sources should be avoided.
- Create and simply reflect objects represented. The characteristics of the display itself should permit drawings of adequate quality. Poorly formed or fuzzy shapes will inhibit recognition.
- Create consistent shapes. Create consistency in shapes of families of icons and in identical icons of differing sizing. Consider animating the icons. Recent research (Baecker ET al., 1991) has explored the use of bringing to life on screens the icons representing the objects and actions.

- **Attach a caption to assure intended meaning.**
The ability to comprehend, and learn, icons can be greatly improved by attaching textual captions or labels to the symbols.
- **Make sure icon stands out from background.**
The icons should explicitly stand out from the background so that it is perceived correctly by the user, there should not be visual chaos that causes strain to eyes
- **Simplify appearance.**
Icons should be simple and clear. Any extraneous decorative parts should be carefully weighed against the confusion they may cause the viewer. The visual differences in an icon should be as significant as possible from a communication perspective; otherwise, the random or idiosyncratic changes merely add more processing time for the human mind and create a possibility of errors of interpretation.
- **Use color with discretion**
Too much variation will confuse the viewer with distracting clutter. In general, for color displays it is reasonable to use five or fewer colors (including black, white, and gray) for icons.
- **Evaluate the designs by showing them to potential viewers.**

Icon design process

- **Stating the idea**
The designer must be able to state the idea that the icon will stand for and the context in which the icon is going to be interpreted.

following is a heuristic for designing icons for associated ideas (rf. Lodding, 1983):

<p>The idea to be communicated is itself an object (e.g., mountain)</p>	<p>Look for an image based on a representational relationship</p>
<p>The idea to be communicated is an abstract concept (e.g. hierarchy)</p>	<p>Look for a design that focuses the viewer's attention upon that a property of the image that carries the intended concept. The design is more difficult since it must attempt To focus the viewer's attention on a particular aspect of the image rather than on an object that the image can be said to represent.</p>
<p>There seems to be no means of tying the intended</p>	<p>Message to an object or quality of the object. The image must be "invented" and assigned a meaning, which the viewer will have to learn.</p>

- Rendering the Icon Image**
 In general, sketches of the icon should be done and tested before detailed icon rendering. A well-designed icon will have simplicity of shape (global features) and a distinct separation of figure from Ground. When an icon is going to be a member of a larger group of icons designed to convey related information, Consideration must be given to tying the collection together in a way that will allow the viewer to see the Relationship of the parts to the whole.

- Testing an icon
Potential users to get feedback and make necessary changes
depending upon user perception should test icons

Ch. 5
typology

Typology of Icons

image	Type of icon	Basis of connection	Idea for which the icon stands for
	Pictograph	resemblance	Mountain
	Symbol	analogy	Hierarchy
	Sign	Arbitrary learned association	danger

When a viewer encounters an icon, the viewer must Comprehend what the icon depicts (e.g., a triangle) Form a link between what is depicted What the icon is suppose to stand for (e.g., a mountain, a hierarchy, danger).

Comprehending the icon

Comprehending what the icon depicts in the case of a triangle is relatively straightforward. In general, however, viewers of icons must "decode" the image. There is theory and evidence that decoding is facilitated when icons emphasize basic features.

Wandmacher (1987) hypothesized that basic features of figures (e.g., shape, color, and size) can be selected and responded to, considerably faster than local features (e.g., lines and structures within a figure). Icons could be categorically differentiated as follows.

- icons that emphasized one global feature (shape) and made the icon more distinctive;

- icons emphasizing local features (that made the image more "representational")

Comprehending Icons for decoding

There are two factors that can interfere with viewer's ability to decode an image online

Spatial Distortion

Spatial distortion occurs when the image is either too complex or, having been designed on a high-resolution Display, is shown to the viewer at low resolution. To counter spatial distortion, the best course is to avoid the use of extremely complex lines and shapes.

Color Distortion

Color distortion can occur when the type or state of the display device cannot be guaranteed, for example, when An image is output to a monochrome device, or when the color set is unknown or changing (i.e., a color-mapped terminal). To counter color distortion, never allow color to be the sole carrier of information in an icon.

The Role of Context

The context of interpretation can affect the viewer's interpretation of what an icon "stands for." For example, a Triangle on a map may more readily be interpreted as standing for a "mountain;" a triangle in a business textbook more readily interpreted as standing for a "hierarchy;" etc.

The Role of Lexical Labels

There is only indirect evidence on how icons and lexical labels may interact. Smith and Magee (1980) found that when subjects were asked to categorize pictures, the presentation of an incongruent word (e.g., the word "car" shown with a picture of a table) did not interfere with their processing of the picture. Although far from conclusive, this result suggests that lexical labels on icons will not interfere with the

response times of viewers to icons and may help them form a link between the icon and the thing the icon stands for.

Linking icon with its idea

Forming a link between the icon and what the icon stands for. There exists models that predicts, icons that operate on the basis of representation (pictographs) will be more easily interpreted (i.e., the viewer will more readily form a link between the icon and what the icon stands for) than icons that operate by analogy.

Icons that operate by arbitrary signs cannot easily be interpreted (i.e., it is difficult to discover the link), the viewer must learn the meaning perhaps with the help of context.

Ch. 6 colors in GUIs

Use of colors in graphic user interface

- Use a maximum of five, plus or minus two colors. Four distinct colors are appropriate. Allows extra room in short-term memory that can store: five words or shapes, six letters, seven colors eight digits. Computers can provide 16 million colors; humans can discriminate about 7.5 million colors.
- Use center and peripheral colors appropriately. Use blue for large areas, not for text type. Blue is good for slide and screen backgrounds. Use red and green to capture attention. The visual field adapts easily to this.
- Use same color for grouping related elements. Cognitive science has advanced the notion of set and pre attentive processing. In this context, you can prepare or set the user for related events by using a common color code. A successive set of images can be shown to Related by using the same color. Similar colors can have similar meanings.
- Use redundant coding of shape as well as color. Makes the display more resilient to color distortions. Ambient light changes can cause changes in perceived hue, value (lightness), and chroma (saturation).
- Avoid blue for text, thin lines, and small shapes. Our visual system is just not set up for detailed, sharp, short wavelength stimuli. However, blue does make a good background color and is perceived clearly out into the periphery of our visual field.
- Avoid adjacent colors differing only in the amount of blue. Edges that differ only in the amount of blue will appear indistinct.

- Avoid red and green in the periphery of large-scale displays. Due to the insensitivity of the retinal periphery to red and green, these colors in saturated form should be avoided. Yellow and blue are good peripheral colors.
- Opponent colors go well together. Red and green or yellow and blue are good combinations for simple displays. The opposite combinations - red with yellow or green with blue - produce poorer images.

Color Terms and Concepts

Hue

Hue is the spectral wavelength composition of a color that produces perceptions of being blue, orange, green, etc.

Value

Value is the relative amount of lightness or darkness of the color in a range of black to white (also called intensity).

Chroma

Chroma is the purity of the color in a scale from gray to the most vivid variant of the perceived color (also called Saturation)

Brightness

Brightness refers to the amount of light energy creating the color.

Ch.7
GUI design dimensions

Semiotic Dimensions

Semiotics is the study of signs, things that stand for something else, visual semiotics is study of visual signs i.e. icons in GUI, the effectiveness of interface depends in part on its using sign well, signs are qualities that allow them to represent the objects or concepts to which they refer.

Icons

Communicate by virtue of their inherent physical characteristics that make them look like objects to which they refer, icons are intuitive, easy to learn and often already familiar from previous experience

Symbol

Are understood on the basis of convention having little or no inherent meaning of their own, they may not look anything at all like objects, structures they represent, which are themselves frequently abstract or without visual characteristics

Indexes

An index refers to that which caused the sign to exist. In GUIs one might describe data-driven displays such as real time gauges or charts as indexes

Lexical dimension

Refers to production of signs. The primary question is how can one display the visible language primitives such as elements of points, lines and areas that contribute to shape, size, colour, texture and orientation

Syntactic dimension

Refers to combination of visual attributes that eventually determine the ease with which visual signs can be distinguished and identified

Semantic dimension

Addresses the normal sense of the word" meaning" (i.e. denotation and connotation) by specifying the qualities of visual sign that allow it to present

Pragmatic dimension

Refers to the consumption of sign, to whether the signs would be perceivable and understandable to the targeted audience

Rhetoric dimension

Metaphor

(literally, a carrying across) something is described as if were something else. In GUIs to say a large rectangular display with a number of small icons is a desktop is to substitute the top of one's office desk for a computers operating system. The entire products are the metaphors of the product data and functions, its nouns and verbs that are organized in mental mode.

Metonymy

A type of metaphor in which an associated symbol is substituted for the thing itself. In a GUI icon, one might use a bolt lighting to refer to the use of a particular device instead of picturing the device.

Prosopopoera

Personification of an inanimate objet, e.g. in global environment issues the earth is depicted as a human-like creature.

Synecdoche

Substitution of a part by whole or a whole by part. In GUIs one might use "T" to stand for all the letters of the alphabet that one can edit with a font-editing tool

Ch. 8
**GUI in computer aided
designing**

An overview of CAD

Computer-aided design involves any type of design activity which makes the use of a computer to develop, analyze, or modify an engineering design, these are based on interactive computer graphics (ICG). Interactive computer graphics denotes a user-oriented system in which the computer is employed to create, transform, and display data in form of pictures or symbol.

CAD Software's are used for

Geometric modeling

Variational modeling

Analysis

Design review

Evaluation

Automated drafting

Graphic software's for CAD –ground rules for interface design

Simplicity

Should be easy to use

Consistency

The package should be operative in consistent and predictable way

Completeness

There should be no incompleteness in the set of graphics function

Robustness

The graphics system should be tolerant of minor instances of misuse of operator

Performance

Within limitations imposed by the system hardware, the performance should be exploited by the software

Study of CAD icon variability

Five CAD softwares with different contextual interfaces were studied for their graphical user interface usability and variability. The softwares and icons were selected on the basis of the user interpretations and commonality in usage. The icons taken for study were either snapshot from desktop or icon file was extracted from the software, care was taken that the icon size and pixelation were same as they were displayed on the screen of their respective platforms. The selected icons varied from various areas of CAD application viz. Drafting, visualization, analysis, editing etc.

Interface of software's under study for GUI variability

Software	interface	icons	platform
AutoCAD R14	Graphical icons	Shade, wireframe, light, render, distance	Windows NT, IBM PC
3DS MAX	Icons, pull down menu	Shade, wireframe, light, render, distance	Windows NT, IBM PC
Pro designer CDRS	Icons, lexical labels	Shade, wireframe, light, render, distance	IRIX 6.2 SGI, Indy R5000
Pro Engineer R20	Graphical Icons	Shade, wireframe, light,	IRIX 6.2 SGI, Indy R5000
Alias Wavefront	Icons, lexical labels	Shade, wireframe, light, render, distance	IRIX 6.2 SGI, indigo2

Ch.9
Methodology for survey

Intensive user based survey

6 subject were asked to fill the following forms. The forms followed the sequence as stated below to avoid any bias.

Stating the best possible guess for the icon images, 20 icons from varied domains of 4 different cad softwares were shown to subjects.

Implication : whether users were able to percieve the intended meaning

Ranking the images for icons of 4 different CAD software's for the same function (5 different sets of functions were used)

Implication: to understand the basis of variability amongst users

Sketching an icon for the above stated functions, which the user feels could be the most appropriate for the purpose

Implication: how varied are users idea for the same function icon.

Randomized user based survey

25 subjects were asked to rank the icons for 4 different set of icons of same function from 4 CAD software's, the rankings were in order of preference.

Implication: to understand user preferences

Ch. 10
conclusion and proposal

User perceivability of icons was essentially on its basis of simplicity and ease in relating to the idea which it stands, the survey of icon variability for cad software's clearly indicated that the graphical elements constituting the system of icon design are of prime importance which include factors like realism, metaphorical relation, associatively whereas secondary elements viz. Grouping conventions, dynamism with colors and 3d representation could be an aid to add visual aesthetics yet not creating a visual chaos and "las vegas syndrome".

The user only operates on the icon as a surrogate representation of the true object of interest, and the user is thus in effect issuing a command to the system. Since the user's actual intent is to perform the task, the gimmick of graphical interface involvement should be minimized by design.

The graphical user interface could utilize multiple usage of icons at one time which are functionally associated.

Next generation graphical user interfaces could be looked upon intelligent systems which can adapt the interaction to the user's specific usage circumstances and location.

Interface would be much interactive if icons could be animated. A screen filled with several constantly animating icons would probably be distracting to users. Alternatively, animated icons can be designed to only animate when the user indicates an increased level of interest in them, for example by placing the mouse cursor within such an icon

Properties of scheduler could be incorporated in icon design to intellectually aid the GUI sequence as required by the function (relevant to CAD packages)

Lexical labels could be thought of being replaced and/or in conjunction with auditory responses (say earcons), this could aid in better understanding the function.

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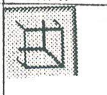













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<http://www.hci.com>

<http://www.usfca.edu/cs/bjturner>

Study3: state your best guess for intended meaning and its basis

 Meta Metaphor	 meta	 Meta	 Meta
Guess Basis wireframe	Guess Basis 3D Rendering	Guess Basis Frame	Guess Basis 3D Rendering
 DONT KNOW	 Meta	 Meta	 3D Rendering
Guess Basis	Guess Basis view	Guess Basis 3D wireframe	Guess Basis 3D Rendering
 DONT KNOW	 Meta	 DONT KNOW	 Known Known as user
Guess Basis	Guess Basis Paint	Guess Basis	Guess Basis scale
 Known	 DONT KNOW	 meta	 (Meta)
Guess Basis lighting	Guess Basis	Guess Basis scaling	Guess Basis small light
 Known	 Known	 Known	 Known (Meta)
Guess Basis Paint	Guess Basis cut	Guess Basis 3D Rendering	Guess Basis Tape

Total time = 6 mins

Basis of guess

- intuitive
- metaphor
- abstract
- implied
- known as software user





















Comments :

Name : HEM SINGH GEDLOT

Profession : DESIGNER


Software used : B. F. A.,

→ Photoshop, flash, dreamweaver, 3D MAX, PAGE MAKER, etc.

render	 Rank: 3	 Rank: 4	 Rank: 2	 Rank: 1
wireframe	 Rank: 3	 Rank: 4	 Rank: 1	 Rank: 2
light	 Rank: 4	 Rank: 1	 Rank: 2	 Rank: 3
shade	 Rank: 2	 Rank: 1	 Rank: 3	 Rank: 4
distance	 Rank: 2	 Rank: 1	 Rank: 4	 Rank: 3

2 minutes

















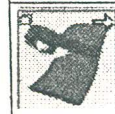



Study 2 : sketch an icon for the stated

render	wireframe	light	Shade	distance
				

icon can be be animated like from wireframe to 3D rendered and so on

2 minutes

Study3: state your best guess for intended meaning and its basis

			
Guess - wire frame Basis metaphor	Guess shadow Basis intuitive	Guess Eraser Basis Metaphor	Guess High-light Basis implied
			
Guess Object Basis Metaphor	Guess ZOOM Basis Intuitive	Guess wire-frame Basis implied	* Guess Render Basis intuitive
			
* Guess Object Basis Intuitive	Guess paint Basis metaphor	Guess scale Basis implied	Guess High-scale Basis implied
			
Guess Light Basis implied	Guess Intersect Basis Abstract	Guess scale Basis metaphor	Guess light Basis metaphor
			
Guess paste Basis implied	Guess cut Basis implied	Guess material Basis metaphor	Guess material Basis can't understand





















7 minutes.

Basis of guess

- intuitive
- metaphor
- abstract
- implied
- known as software user





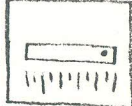
Comments : The objects which have '*' sign - are too abstract or difficult to understand. Very less objects are there, which can be easily understood at first site.

Name : Miss. Pradhya Pande
 Profession : Designer- Visual Communication (B.F.A.)
 Software used :

render	 Rank: 2	 Rank: 3	 Rank: 4	 Rank: 1
wireframe	 Rank: 1	 Rank: 4	 Rank: 3	 Rank: 2
light	 Rank: 2	 Rank: 1	 Rank: 4	 Rank: 3
shade	 Rank: 2	 Rank: 1	 Rank: 4	 Rank: 3
distance	 Rank: 3	 Rank: 1	 Rank: 2	 Rank: 4















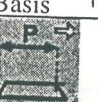





3 minutes.

Study 2 : sketch an icon for the stated

render	wireframe	light	Shade	distance
				

4 minutes.

Study3: state your best guess for intended meaning and its basis

			
Guess Basis SEARCH metaphor	Guess Basis Render known as user	Guess Basis COLOUR known as user	Guess Basis RENDER known user
			
Guess Basis GRADATION intuitive	Guess Basis SEARCH METAPHOR	Guess Basis SOME KIND OF SECTION OF OBJECT OR ABSTRACT	Guess Basis WIRE FRAME/RENDER known user
			
Guess Basis WIRE FRAME known as user	Guess Basis COLOUR known	Guess Basis ARROW/DOTTED LINE IMPLIED	Guess Basis SCALE IMPLIED
			
Guess Basis LIGHTS IMPLIED	Guess Basis 3D OBJECT IMPLIED	Guess Basis DIMENSION IMPLIED	Guess Basis ?
			
Guess Basis JOINT implied	Guess Basis CUT/BREAK IMPLIED	Guess Basis SOLID OBJECT RENDER known as softw.	Guess Basis CAMERA known as softw.

12 mins.





















Basis of guess

- intuitive
- metaphor
- abstract
- implied
- known as software user

Comments : SOME ARE KNOWN BECAUSE OF KNOWN SOFTWARE BUT NOT STANDARDISED.






Study 1: rank the images for icons

Name : AVINASH BHALERAO
 Profession : DESIGNER
 Software used : AUTOCAD, MSWORLD, 3DMAX, ALIAS

render	 Rank: 3	 Rank: 4	 Rank: 1	 Rank: 2
wireframe	 Rank: 1	 Rank: 3	 Rank: 2	 Rank: 4
light	 Rank: 1	 Rank: 2	 Rank: 4	 Rank: 3
shade	 Rank: 1	 Rank: 3	 Rank: 4	 Rank: 2
distance	 Rank: 1	 Rank: 2	 Rank: 3	 Rank: 4







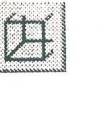






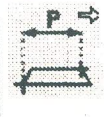




10 min.

Study 2 : sketch an icon for the stated

render	wireframe	light	Shade	distance
				

5 min

Study3: state your best guess for intended meaning and its basis

 <p>create Surface</p> <p>Guess Basis implied</p>	 <p>(Processing) Zonked Metaphor</p> <p>Guess Basis</p>	 <p>Rub (Erase) Intuitive</p> <p>Guess Basis</p>	 <p>Render Implied</p> <p>Guess Basis</p>
 <p>Display Abstract</p> <p>Guess Basis</p>	 <p>check Intuitive</p> <p>Guess Basis</p>	 <p>display without hidden line (implied) removal</p> <p>Guess Basis</p>	 <p>create solid Abstract</p> <p>Guess Basis</p>
 <p>Unrender Implied</p> <p>Guess Basis</p>	 <p>Assign colour Abstract</p> <p>Guess Basis</p>	 <p>measure Intuitive</p> <p>Guess Basis</p>	 <p>Measure Implied</p> <p>Guess Basis</p>
 <p>Render implied</p> <p>Guess Basis</p>	 <p>without Hidden line implied</p> <p>Guess Basis</p>	 <p>Stretch Metaphor</p> <p>Guess Basis</p>	 <p>Lighting Metaphor</p> <p>Guess Basis</p>
 <p>Join surfaces intuitive</p> <p>Guess Basis</p>	 <p>- hit implied</p> <p>Guess Basis</p>	 <p>create objects of rotation about an axis → Abstract</p> <p>Guess Basis</p>	 <p>Tolerances Intuitive</p> <p>Guess Basis</p>

Total time: 15 mins.





















Basis of guess

- intuitive
- metaphor
- abstract
- implied
- known as software user

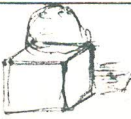



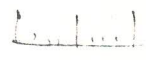
Comments: would definitely like to stay away from packages using such icons.

Study 1: rank the images for icons






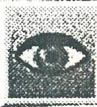








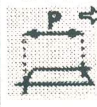





Name : Parikshit Kulkarni
 Profession : CAD softwares encluser
 Software used : Pro/E, ACAD, UG

render	 Rank: 2	 Rank: 3	 Rank: 4	 Rank: 1
wireframe	 Rank: 2	 Rank: 3	 Rank: 4	 Rank: 1
light	 Rank: 2	 Rank: 1	 Rank: 3	 Rank: 4
shade	 Rank: 3	 Rank: 1	 Rank: 4	 Rank: 2
distance	 Rank: 1	 Rank: 3	 Rank: 2	 Rank: 4

Study 2 : sketch an icon for the stated

render	wireframe	light	Shade	distance
				

Study3: state your best guess for intended meaning and its basis

			
Guess lights. Basis implied.	Guess Quick reader. Basis known.	Guess Rabbits to 1. Basis metaphor	Guess reader. Basis known.
			
Guess Surface. Basis metaphor	Guess view. Basis implied.	Guess Don't know. Basis	Guess can't guess Basis
			
Guess reader. Basis known.	Guess Paint. Basis implied.	Guess Don't know. Basis	Guess graph/chart. Basis implied.
			
Guess light. Basis known.	Guess cube. Basis abstract	Guess measure dist. Basis intuitive.	Guess lights. Basis implied.
			
Guess attach. Basis known surface	Guess Detatch. Basis known	Guess spare/cylindrical. Basis metaphor.	Guess Don't know Basis

Total time : 10 m

Basis of guess







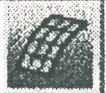













- intuitive
- metaphor
- abstract
- implied
- known as software user

Comments :

Some Icons are very vague or they are over designed, making the understanding very confusing. To much of information should not be there.


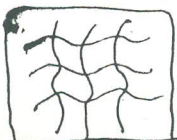
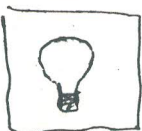

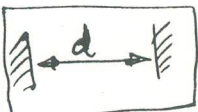
Study 1: rank the images for icons










Name : Sameer Chawan
 Profession : Engineer
 Software used : IDEAS, CATIA, ALIAS, 3D Max, AutoCAD

render	 Rank: 2	 Rank: 4	 Rank: 1	 Rank: 3
wireframe	 Rank: 2	 Rank: 4	 Rank: 1	 Rank: 3
light	 Rank: 1	 Rank: 3	 Rank: 2	 Rank: 4
shade	 Rank: 2	 Rank: 1	 Rank: 3	 Rank: 4
distance	 Rank: 2	 Rank: 1	 Rank: 3	 Rank: 4

Time: 10 min

Study 2: sketch an icon for the stated

render	wireframe	light	Shade	distance
				

			
Guess Basis surface construction known as soft-	Guess Basis Rendering known - ...	Guess Basis Edit abstract.	Guess Basis Rendering implied
			
Guess Basis display setting intuitive	Guess Basis View/camera implied	Guess Basis wire frame construction implied	Guess Basis edit views
			
Guess Basis Not perceived	Guess Basis paint implied	Guess Basis stretch intuitive	Guess Basis dimensions implied
			
Guess Basis lights known as....	Guess Basis editing intuitive	Guess Basis dimensioning Implied	Guess Basis lights implied
			
Guess Basis attach known as---	Guess Basis detach known as...	Guess Basis Duplicate intuitive	Guess Basis camera abstract

Basis of guess

- intuitive
- metaphor
- abstract
- implied
- known as software user

Comments: Total time 10 min.

⊙ The icons with , pictures , more related to the real life are easy to understand for eq. rendering or lights etc.





















⊙ Only line diagrams as icons are difficult to perceive.

Study 1: rank the images for icons

Name : Tushar N. Dani






Profession : Designer

Software used : Alias wavefront, Euclid, Pro-E, 3D-studio, Coreldraw, Photoshop, paint brush, photopaint, word, pagemaker,

render	 Rank: 3	 Rank: 4	 Rank: 1	 Rank: 2
wireframe	 Rank: 1	 Rank: 4	 Rank: 3	 Rank: 2
light	 Rank: 1	 Rank: 3	 Rank: 2	 Rank: 4
shade	 Rank: 2	 Rank: 3	 Rank: 4	 Rank: 1
distance	 Rank: 2	 Rank: 1	 Rank: 3	 Rank: 4

Total time : 4 min.





Study 2 : sketch an icon for the stated

render	wireframe	light	Shade	distance
				

Total time : 10 min.





Instructions

- See the icons in columns below
- These are icons used in 4 different CAD software to represent "render" option
- Rank the icons according to the preference, which you feel is best for render option

Icons/subjects				
			1	
1	3	4	1	2
2	1	3	2	4
3	1	3	2	4
4	1	4	2	3
5	1	4	3	2
6	1	4	2	3
7	1	2	3	4
8	1	2	3	4
9	1	2	3	4
10	2	1	3	4
11	1	2	3	4
12	2	1	3	4
13	2	1	2	2
14	2	3	1	1
15	4	3	2	1
16	3	1	2	4
17	2	1	3	4
18	4	2	3	1
19	2	1	-	-
20	2	-	1	3
21	1	2	3	4
22	2	1	4	3
23	3	3	2	1
24	4	2	1	3
25	3	1	2	4
Max first Ranks	10	8	4	4





Instructions

- See the icons in columns below
- These are icons used in 4 different CAD software to represent "wireframe" option
- Rank the icons according to the preference, which you feel is best for wireframe option

Icons/subjects				
1	4	2	3	1
2	4	3	2	1
3	4	1	3	2
4	4	3	2	1
5	4	3	2	1
6	3	4	2	1
7	4	3	2	1
8	4	3	2	1
9	4	3	2	1
10	4	3	1	2
11	4	2	3	1
12	4	3	2	1
13	4	2	3	1
14	1	2	4	3
15	1	1	3	4
16	1	3	2	4
17	4	3	1	2
18	4	3	2	1
19	1	2	4	3
20	-	3	1	2
21	-	2	-	1
22	4	2	-	1
23	3	2	1	1
24	4	2	3	2
25	2	3	4	1
Max first Ranks	4	2	4	16

Instructions

- See the icons in columns below
- These are icons used in 4 different CAD software to represent "light" option
- Rank the icons according to the preference, which you feel is best for light option

Icons/subjects				
1	4	2	3	1
2	2	1	3	4
3	4	1	3	2
4	3	1	4	2
5	3	1	4	2
6	4	2	3	1
7	4	2	3	1
8	1	3	2	4
9	3	4	2	1
10	2	1	4	2
11	1	2	3	4
12	2	1	3	4
13	2	3	1	4
14	2	4	1	3
15	2	4	2	3
16	1	4	2	3
17	4	3	2	1
18	1	4	2	3
19	2	4	1	3
20	3	4	2	1
21	3	1	—	2
22	1	3	2	4
23	2	2	3	4
24	1	2	4	3
25	2	1	3	4
Max first Ranks	7	8	3	5

Analysis based on icon guessing survey

Subjects/guess basis	intuitive	metaphor	abstract	implied	Known as user	Can't percieve
Subject 1	0	9	0	0	6	4
Subject 2	5	3	4	7	1	0
Subject 3	4	0	3	7	5	1
Subject 4	4	7	1	6	1	2
Subject 5	1	3	3	5	5	3
Subject 6	2	2	1	7	7	1
Total	16/120	24/120	12/120	32/120	23/120	11/120

Basis of analysis*Simplicity*

How simple are icons in visual graphics

Perceivable

How easily are icons perceived

Direct meaning

Is the meaning explicit or implied

Negative connotations

Does the icon give any negative connotations of intended meaning

Representational

Whether 2d or 3d representation is well understood

Stand out from background

Does the information to be conveyed stand out from background of its display

Dynamism with colors

Value addition in terms of color appeal

visual chaos

amount of contradictory constitutional elements

number of elements

are the number of elements kept minimum

lexical labels

are the icons related to the lexical labels on it

associativity

are icons understood because of its associativity with other group icons

naturalism

do icons look natural

activation

does the icon passively await activation

Analysis of "render" icon of 4 CAD software's

