Why do New Interfaces Scare Me?
Exploring Affective Design Principles in User Interface Design

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Abstract
Why do some of us experience excitement when we approach new digital interfaces, whereas others experience caution or even fear? The isoBrowser project begins with an investigation into our initial reactions to interface, examining the area of affective design in relation to computer interface. These findings then contribute towards the development of a prototype Web-history browser. Testing focuses on initial user experience, and the results are used to inform subsequent development. This project, which also draws on other sources, suggests an alternative framework for designing computer interfaces.

The familiar computer graphic user interface (GUI) makes extensive use of visually representative devices such as folders and files. These symbols interpret computer data and operations that otherwise have no physical form. The computer's underlying complexity is symbolised for the user, who is then able to manipulate the computer by interacting with the interface. How the user interprets the icons and controls on the screen is determined by a multitude of factors, including user's prior experience, the effectiveness of the interface, and the eventual success of the operation. These and other factors create an "engagement" between the interface and the user, and it is at this point that this study begins.

Affective Design
Over recent years, aspects of affective psychology have been considered as significant contributors to the success of product design, including computer interfaces. This term has been adopted by researchers to refer to the emotion, feelings and moods experienced by users when dealing with a product.

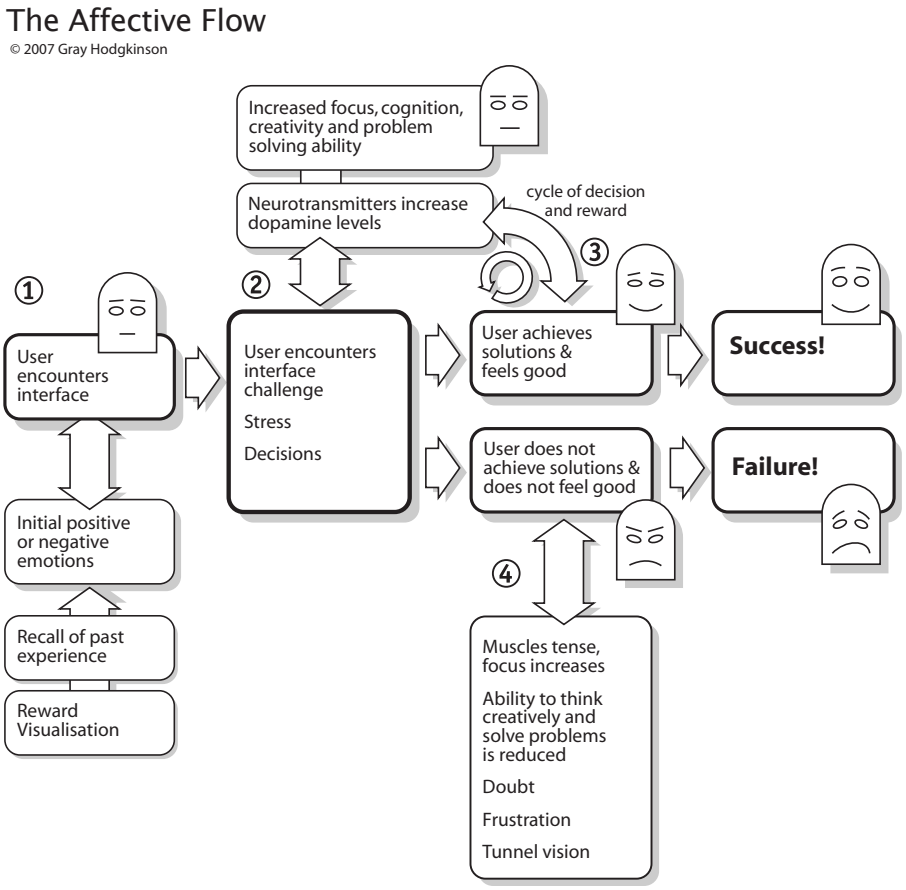
Norman (2004) describes how a relaxed state of mind enables a user to solve problems more easily, thus contributing to greater usability of a system. An anxious user, however, is more likely to focus intently on a problem to the point of tunnel vision, perhaps repeating an operation several times, just in case the computer didn't "get it" the first time. After repeated failure, the anxious user gives up, avoids the issue, or tries alternative solutions.

Though debate continues in fields of psychology as to whether we are motivated chiefly by emotion or rational thought, it is accepted that emotion plays a significant part in decision making. Key research supporting this finding comes from Damasio (1994), who found that patients who had emotional impediments, had an inability to make decisions, even very inconsequential ones. As supported by Picard (1995), "Emotion does not merely play a tie-breaking role in making certain decisions; rather, it appears to be essential in learning the biases required to construct rational responses". Picard concludes that there is no part of the brain that is purely rational. The emotional activities of the brain play a vital part in all cognitive activities.

Ashby et al (1999) refer to research showing that positive emotion can also systematically affect cognitive processing and improve creative problem solving. This is largely due to the effects of the neurotransmitter chemical dopamine in the anterior cingulate part of the brain. The anterior cingulate provides a mediation type of communication between the prefrontal cortex and the limbic, connecting, if you like, cognition with emotion. Amongst other roles, dopamine "mediates the cognitive effects of pleasant feelings that may be denoted by self reports of pleasure, happiness, or satisfaction" (Ashby et al, 1999).

The same chemical, dopamine, also improves cognitive flexibility (Ashby et al, 1999), as well as attention and focus, by protecting "goal related delay activity against interfering stimuli" (Marr, 2001, citing Durstewitz et al, 1990). This means that if our user is of positive disposition, their problem solving abilities increase, they feel good about it, and their focus increases, to the benefit of solving the problem. A win-win cycle.

These behaviours form a very interesting sequence of learning events (see diagram below "The Affective Flow").



Step 1. User encounters interface
Shultz (Holleram and Shultz, 1998) has been involved with several studies that demonstrate how dopamine levels vary according to the prediction of the reward. It is the body's way of highlighting the best outcome, and setting up a memory, or somatic marker (Damasio 1994). "This was good, let's do it again". As summarised by Marr, (2002) it is the new knowledge, or surprise reward that produces the greatest pleasure and therefore most encourages learning. In relation to the interface, the user's first reaction may be to recall their own background knowledge, which could encompass several emotions, such as success, indifference, or failure. If the past experience was pleasurable in some way, the recalling of the reward will induce reward anticipation.

Step 2. User encounters interface challenge
This is the stage where the user is challenged and will need to make decisions. Increased focus improves cognitive ability and increases the likelihood of achieving a successful outcome (Donahue 1993). This approach is tending to replace the "flight or fight" theory. Flight or fight implies that the increased focus impedes lateral thought and reduces the likelihood of finding a solution. However, this increased focus state, including muscle tension, can also mean "readying the body for action", in this case, a decision making action. The state of increased focus therefore can be seen as a state of increased cognition, increased problem solving ability, all together with excited anticipation of success and reward.

Step 3. User achieves solutions and feels good
If the user is successful, their decisions are confirmed, and the experience of these are reinforced, both emotionally and rationally. A cycle of decision and reward has been established, and the user anticipates this continuing. All is good.

Step 4. User does not achieve solutions and feels unfulfilled
However, if the user is unsuccessful, the neurophysiological boost is not experienced. All of the positive reinforcement has been for nought, and the user, in essence, has to start again. Furthermore, the user now has negative reinforcement of the failed process.

Reward anticipation is an inbuilt part of operating a computer. The simple act of opening a folder is a process of anticipation, action and reward. More so as the result is hidden from view until the action is taken.

Affective design and product design
Product design, in particular, has been dealing with the emotional interaction of users for many years. If a product functions in a certain manner, then its look and feel, its emotional affect, must also reflect this. In this way, the nature of the product is communicated to the client on a rational, functional and emotional level. Usability is no longer the prime goal. Usability is now an expectation, (Jordan 2000). Consumers expect usability, and are surprised and dissatisfied when a product does not perform well. Jordan also uses the terms "formal" and "experiential" to describe how a product's performance can be relative according to the expectation of the user. A recreational user may enjoy watching animated folders opening on the computer screen, whereas a professional user would not. With successful user experience comes "engagement". This state of immersed engagement has been recognised as an essential element of successful human-computer interaction. Several commentators have likened our relation to a computer as similar to an engaged interaction with another human being. With greater engagement comes the higher probability of problem-solving and eventual reward.

Specific issues with Web browser history that impede user engagement and reward
As a user browses the Web the browser records a list of visited websites. The most commonly used browsers present this history to the user in a list format, either in a sidebar or as a drop-down menu item. This list approach, in general, has several inherent issues and causes significant problems for the user when they come to access and use the history data. For example, the history list has the fundamental flaw that the list created by opening Web pages can be altered by subsequent retrievals. Regardless of when the Web page was first recorded, every retrieved viewing of the cached page re-orders the page's place in history. Which history is the preferred one? Does the user envisage the history as a record of when they first encountered the page, or a record of when they last looked at it? Most systems make no distinction between the two.

Another fundamental usability problem lies within the back button. The back button uses a hierarchical stacking system to record a user's page sequence. If the user returns to an earlier page, and then follows a different link from that page, they will create a new hierarchical branch. The back button will now only recognise the new branch. User's tend to assume that the back button simply records pages viewed, and generally do not understand why it sometimes does not work. Even if a user was aware of this limitation, it would be conceptually difficult to keep a track of when pages become unavailable. Most users simply click back and hope.

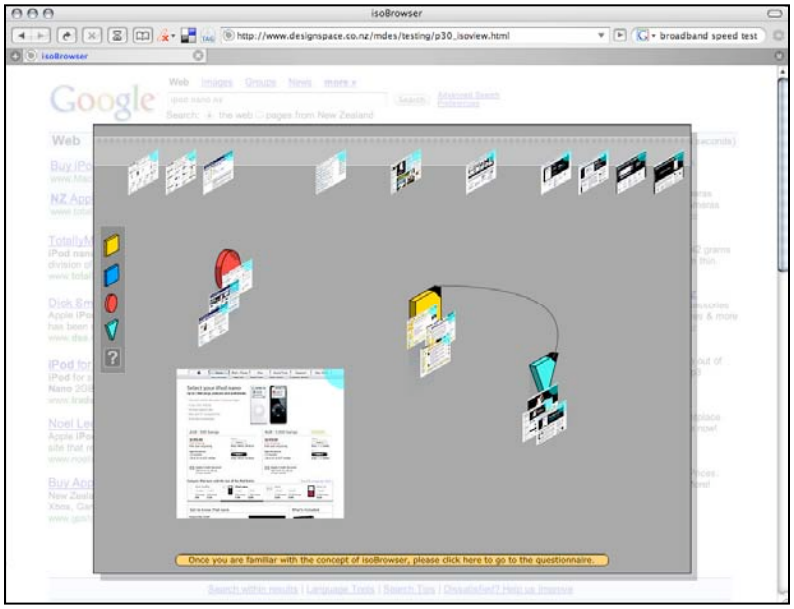
Thumbnail images
The addition of thumbnail images provides significant improvement to a history list's success hit rate, and has been popular with history list research for several years. Kaasten et al (2001) report that users using text-only lists had a 60% success hit rate of recognising a page. Once thumbnails were included, the success rate increased to 80%. Kaasten et al concluded that users generally felt that thumbnails were good representations of pages. Users were able to use colour, layout and dominant text to identify individual pages even at very small sizes. The Data Mountain project by Robertson et al (1998) allowed users to place thumbnails freely on a sloping plane. Users reported a favourable reaction to the informal, manual method of arranging files spatially, in their own personal manner. Storage times, retrieval times, and retrieval accuracy were reported as being reduced due to the users use of spatial memory recall.

The increased use of thumbnails also highlights the roles of history lists and bookmarks. Once a user moves a thumbnail, the historical sequence is interrupted, and the thumbnail effectively becomes a bookmark, ie, a stored location. This suggests that a truly useful history list should also function as a bookmarks list, allowing reorganisation of the chronological order in a manner that suits the user's needs.

BumpTop by Agarawala and Balakrishnan (2006) demonstrates very flexible organisation methods. BumpTop uses a literal desktop metaphor, with all objects having physical properties such as weight, mass, and collision behaviour. Based on real world office worker behaviour, the authors developed an impressive range of pile stacking techniques, that could be applied to the Web browser environment.

Testing and Evaluation
To put principles into practice, the isoBrowser interface was developed. This design was adapted from a previous project that used inspiration from the Constructivist fine artist El Lissitzky to inform interface design (Hodgkinson

2005). A limited functioning prototype was built using Adobe Flash, which gave the illusion of an operational interface. Responses from users were collected via an online survey built into the interface, so users could give feedback with reactions fresh in their minds. Prior to arriving at the isoBrowser interface, users were led through a browsing scenario, covering several actions such as using the back button, selecting a page from the history list, and frequent returns to a Google search page. The purpose of these varying actions was to highlight how a history list does not necessarily reflect the nature of the user's browsing experience. Once arrived at the isoBrowser interface, users were asked to explore freely, and to then perform a given task.



The isoBrowser interface floating over a Web page

Key functions of the interface include a drag-able timeline, freely moveable thumbnails, magnetic-like sticking behaviours, stacking options, and optional connecting curved lines. Thumbnails have a pop-up larger sized preview, and upon double clicking, open the thumbnail's site.

Results and deductions from user feedback

Twenty-five users took part in the user test. The majority of the users (80%) were familiar with and regularly used the back button and history list. Over half of these users also tab browsed. A selection of features stood out as being innovative and worthy of pursuing in on-going work:

Visual representation of interface function

Most users were impressed by the visual representation of the interface's functions and in general anticipated successful operation prior to actual use. Of the group, 84% had either a reasonable or good idea of how the interface would work. In terms of anticipated enjoyment, 50% of users felt that either the interface looked like fun or mostly looked like fun.

Features

Of the different features, the scrollable timeline rated highest with 25% positive response. Thumbnail dragging and grouping received 21% each, with connecting lines, interface design and colours rated least important. Written responses indicated that users had differing opinions on the connecting lines concept, and that a greater degree of control could be developed. Some respondents requested visual feedback of first-browsed positions on the timeline. The assumption that users would discard the timeline position once the page was removed appears to have been premature. The original location still holds valuable cues for some users.

Dragging and grouping objects

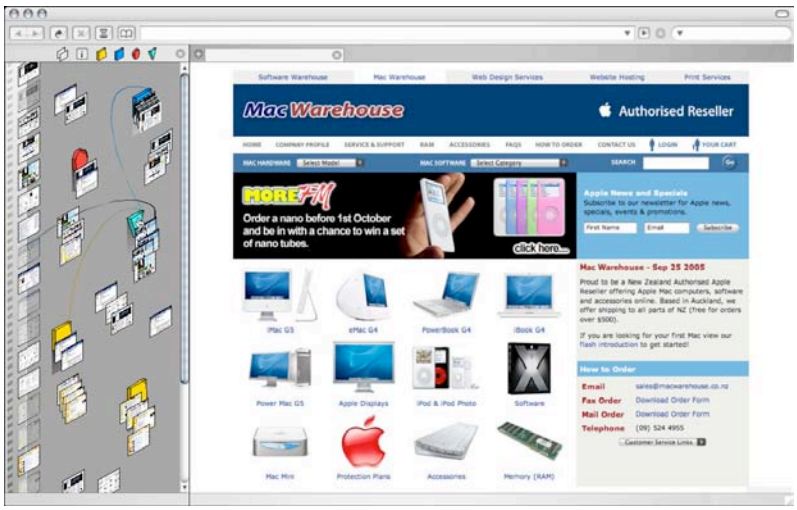
In terms of spatial positioning, 88% of users either absolutely or partially agreed that spatial positioning aided their ability to recall the page. Some users (17%) requested extra levels of information, such as pop-up text labels showing original Web page titles and other useful details. When asked to perform a specific retrieval task, 45% felt

the interface was helpful or mostly helpful. When asked if they would use this interface for everyday work, the strongest response of 63% was for “Sometimes, when I felt I needed that method of organising my browser history”. A further 12% indicated that they would use the interface once extra features were implemented.

The merging of history list and bookmarks appears to have been successful. As users dragged their pages off the timeline, they ordered them to suit their own tastes. The term “bookmarks” became less significant: they were simply being placed and grouped where they wished. This combination of lists happened naturally.

Design improvements

In the desire to integrate the interface more tightly with the browser, a static mock-up as a browser side panel was produced.



isoBrowser in a vertical side panel format

Immediately the reduction of work space was apparent. The first prototype had a spacious working area, and few users raised any issues regarding available space. The large space gave a natural impression that a typical collection of history items could fit into such an area. But with the side panel option, the initial impression is the opposite. The simplest solution to increase space would be to make the panel scrollable. This would be a separate function to that of the timeline, and could have any user-defined limit.

Thumbnail behaviour

When pages are dragged off the timeline, ghost images will remain indicating the original browsed chronological placement. Users can snap the pages back onto the timeline if they wish. Various ghost-image clean-up options could be offered. Upon page thumbnail rollover, pop-up panels would display information of page title, URL, first browsed date and last visited date. Various stacking options of thumbnails could also be offered to the user. Though at first this may seem similar to moving files into a folder, the intention is to remain at one interface level. Stacks would unfold upon rollover or clicking. Once opened, specific pages could slide out upon rollover for further navigation. (see images below)

Rollover group tag
Rollover of a group tag object will reveal any connecting lines created by the user to other group tag objects. The lines will also adopt the colour of the connected object to reinforce the linked relationship. Users would be given line display options, such as hide, thickness, and range.

These improvements attend to most of the issues raised by the first round of user testing. The move to a side panel working space is expected to generated new issues, and it will be interesting to build and test a second prototype.

Summary

The path from affective design principles to working prototype is only one part of a larger design framework. This framework also includes inspiration from fine art, principles from graphic design and interface design, as well as an awareness of the history and development of computer interface. This type of multi-disciplinary approach should assist designers through an informed design processes, and produce better interfaces for users.

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