Skeuomorphism or flat design: future directions in mobile device user interface (UI) design education

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Biography

Tom's background is in electro-optics development and production and worked for Ferranti Defence Systems Ltd. in Edinburgh. In 1990, he took up a two-year fixed-term research assistantship at the Engineering Design Research Centre in Glasgow. Upon completion of this role, he taught Computer-Aided Engineering at the University of Hertfordshire in Hatfield. Since moving to Loughborough University in 2003, Tom has taught electronic product design, interaction design, design and manufacturing technology and physical computing. His research interests are in engineering design, value management, technology education and electronic product design.

ABSTRACT

Skeuomorphism in user interface (UI) design has received much attention and criticism about its usefulness and purpose the design of smartphone apps. The argument of whether or not Skeuomorphism still has a place in UI design is explored in this paper. A questionnaire survey was undertaken by design students to establish their awareness of Skeuomorphism and their opinion of its relevance in UI design. The results showed a lack of knowledge about the areas of UI design but once fully explored they agreed that Skeuomorphism is relevant but not as a standalone process. However, it has been identified as a design tool that may be used in conjunction with other processes as shown by Google UI design exploring Skeuominimalism. They also come to state that they found the research involved very useful to them improving their knowledge on the topic and developing their skill set as a designer.

Keywords: Skeuomorphism, Flat Design, User Interface Design, Education.

INTRODUCTION

Over the past few years, Apple's iOS and Mac OSX operating systems and applications (apps) have received much attention among design writers over the excessive use of Skeuomorphic design techniques (Downer, 2012). Whereas with the more recent release of Windows 8 operating system by Microsoft and its 'novel' UI design that has be named 'Flat Design' has sparked a debate over which approach is better and if Skeuomorphism still has a place in UI design (Greif, 2013). Greif (2013) argues that apple design follows an approach of using realism with faux textures, drop shadows, visual metaphors and the direct use of Skeuomorphism as apposed the approach Microsoft have recently adapted with the rise of 'flat design' using minimalism and colour to express the intentions of the UI design (Hooten, Hayes and Adams, 2013). Nevertheless, some designers are arguing the case that UI design should be neither one

nor the other but instead should use them both as design tools. Furthermore, they may be used in conjunction with each other when and where it is relevant to get the best out of the design intent. This approach has been named "Skeuominimalism" and uses the best of both Skeuomorphism and Flat Design (Baranuik, 2012).

The aim of this research was to examine and discuss Skeuomorphism and to determine its future in UI design as either singularly or as a design tool used in conjunction with flat design to help the overall design process (Hashimoto, and Clayton, 2009). Furthermore, this work explores and discusses Flat design in opposition to Skeuomorphism and to give a wider perspective on the topic explore the idea of Skeuominimalism and using Skeuomorphic elements when designing a UI. It is expected that this will help designers understand the areas of UI design and allow them to make informed decision as to which design approach to use when creating their own designs.

2   LITERATURE REVIEW

A skeuomorph may be described as an object or feature which imitates the design of a similar artefact in another material or technique. It may also be defined as an element of design or structure that serves little or no actual purpose of the product in the new material but was essential to the object being made in the original material (Basalla, 1988). In more simplistic terms it could be used to described the way in which a design uses a feature from a past design even when the original function of the feature is no longer necessary (Greif, 2013). Skeuomorphic features may be found in use on a day-to-day basis, such as the pre-recorded shutter noises on smartphones used to let you know when a photo has been taken. This is Skeuomorphic as the shutter noise was a feature of the original design of mechanical cameras but serves no purpose in a digital smartphone camera (Downer, 2012).

Norman (1988) stated that in order to understand where Skeuomorphism originated we have to look back to ideas of 'Mimesis' and path dependence in technology where the functional behaviour is maintained and when the reason for its design is no longer relevant. Mimesis is both critically and philosophically used to describe a wide range of meanings, imitation, representation and mimicry. It may often be restricted to aesthetics or imitation, neither of which reveals the dimension of mimesis of the variety of meanings and connotations attached to the term. Mimesis is a human condition and plays a role in a wide variety of human thought and action (Wulf & Gebauer, 1995a).

Mimesis may be seen in today's society as the aestheticisation of the world is now perceived through the images of the mass media. They create ostensible realities through the use of images and video and due over exposure they become surrogate experience of reality and change the expectation and reality of society (Kelly, 1998). Mimesis allows individuals to step out of the ordinary and their own comfort zones to draw inspiration from the outside world inside and to add cultural and social expression to their inner thoughts (Wulf & Gebauer, 1995b). The process of imitation has all ways played a primary role in the examination of creative processes, In Aristotle's Poesis it states 'the natural human inclination to imitate is described as inherent in a man from his earliest days, he differs from other animals in that he is the most imitative of all creatures and he learn his earliest lessons through imitations' (Durix, 1998). Mimesis may be seen as something that humans and nature have in common that is not only

embedded in the creative process but also in our DNA (Odom, Blevis, and Stolterman, 2008).

More common in UI design are digital skeuomorphs due to emerging boom in digital technology and use of the technique by Apple and application designers alike. Digital skeuomorph tends to be used in the form of graphical UIs that replicate objects in the real world; digital Skeuomorphism can be traced back to the visual metaphor designers (Cyr, Head, and Larios, 2010). Over time Skeuomorphism has seeped into all areas of UI design, especially in apples software, where text documents for example are made to look like yellow legal pads (Carr, 2012) shown in Figure 1.

Figure 1: Example of a digital skeuomorph - Apple Notes Application

Some examples may be found in the music industry in editing and audio processing software such as Apple's Garageband application. This can be seen in the functional aspects of the UI within the controls such as knobs, buttons, sliders and switches, which have been replicated from the original designs of the physical devices, they are mimicking. Some even includes design interface features that serve no purpose at all such as handles, screws and stitching.

The current Skeuomorphic design debate implies a connection to a past incarnation of a feature of a similar design, is not all ways accurate but is actually often about realism (Greif, 2012b). The most common misconception of all is that a UI that contains realistic looking elements but doesn't actually mimic any physical object is Skeuomorphic (Ziefle and Bay, 2006). In reality it's completely aesthetical (Carr 2012) as realism is a purely visual style. The word Skeuomorphism is continually being misused, what is being called Skeuomorphic is not actually Skeuomorphic at all, they're kitsch visual metaphors (Baranuik, 2012). It could be referred to as 'realism' or 'simulacra. This is when something is referred to the likeness of a real object but behaves differently which is commonly seen in current UIs when Skeuomorphism is badly of incorrectly implemented into a design without sound decisions from the designer.

Another notable example of this is with apple's 'find my friend' app that may be seen in Figure 2. On the surface it's clad with faux textures of tanned Corinthian leather with stitched on tan and tool bars giving it the appearance of a poker table. As aesthetically similar it looks to a real life poker table, 'find my friends' is based on something completely fictional meaning the features are not directly linked or used from one design to another making it realism not Skeuomorphism (Downer, 2012). It because of UI designs like this that are creating negative impact on the way Skeuomorphism is viewed in the industry when in fact they are just kitsch visual metaphors that are just bad design.

Figure 2: 'Find my Friend' App UI.

Skeuomorphism may be used in many different ways to help familiarise users to a new product and technology. Society has reached a stage where it is constantly releasing

new technology's and designs which are becoming increasingly interactive (Downer, 2012). Thus requiring the user to adapt the way they use products and Skeuomorphism may be used to ease this transition into this new phase of increasing technological consumption (Brajnik, Yesilada, and Harper, 2011).

It may be said that there is a validity to Skeuomorphic design as to create any UI it is essential for the designer to understand the cognitive models that a user brings to any new product (Hobbs, 2013). For example, if an object casts a shadow our brains automatically visual that as 3D shape that has volume. It is these types of affordances that Skeuomorphic design gives to designers that should be taken advantage of and mimic in interface design (Sanchez, 2012).

On a smartphone apps take up the entirety of the screen, which means you never display two apps next to one another. Thus you can have two apps with very different visual styles without risking incoherence (Greif, 2013), allowing designers to create their own individual design style that lets there design stand out in a very competitive market. It may also make the app feel intuitive to a first time users without having them read a manual or sit through a tutorial (Hollan, 2010). It is also a novelty user experience the first time users creating a certain appeal and making them want to user it and engages positive emotions in people (Downer, 2012). Skeuomorphism and realism may trigger strong connections with real world designs. All though this may be seen as a strength of Skeuomorphism sometimes, the association may be so strong that it will stop you from improving on what's already been done (Greif, 2013). Skeuomorphism if done wrong may morph into kitsch visual metaphors, But the real problem lies in the very concept and function of Skeuomorphic interfaces, regardless of whether their appearance is realist or not. The problem is when borrowing features from the original design, you often also brings its limitations along for the ride, even when these limitations have no reason to exist anymore (Greif, 2013) which end up having a negative impact on the UI.

There is also the problem of getting Skeuomorphism wrong; making something look like a physical object but not work like it. This can be seen in apple's contacts app for the iPad, which like 'ibooks' uses the visual metaphor of a book with pages. But unlike 'ibooks', the 'contacts' app doesn't let you swipe left and right to flip pages, breaking the direct link to the books metaphor and turning it into a purely aesthetical tool which removes the Skeuomorphic design element. The use of a wooden thermometer can also be used as an example of bad Skeuomorphism, because people presume that just because you are using a gaudy texture that it must be Skeuomorphism, when in fact because a real thermometer was made out of wood it was just a bad design and mixing metaphors which is often done when designers use Skeuomorphism without thinking and just implementing it into a design even when it is not suitable (Greif, 2012b) see Figure 3.

Another consequence of skeuomorphism is that when merging real-life visuals with digital interactions the 'model' starts to break. You end up with leather buttons, serif type on a lined notepad and false affordances like pages that cannot be turned. So as it tries to create familiarity to users it can also create confusion and awkwardness (Sanchez, 2012). There are a few side-affects to this surge of realism, which are being seen as bad uses of Skeuomorphism. The real issue is when Skeuomorphism turns into a trend it starts to be used for the wrong reasons and designers just start using certain

effects as a default tool to fall back on. Designing useful Skeuomorphic UIs be hard but when done correctly it enhances the learning of the application and engages the user.

Skeuomorphism is like any other design technique and it can be misused. Due to excessive use by Apple and like-minded designers it has created distaste for it among the web design community. Thus resulting in the current Skeuomorphism versus Flat Design debate. In essence, Skeuomorphism is not all bad but overusing its unnecessary ornamental visuals can be considered cliché and a bad design choice. But using physics and 3D affordances make it easier for us humans to interact with apps and thus we are designers should take advantage of that (Sanchez, 2012). Thanks to apple, realism often miss-labelled, as Skeuomorphism has been the dominant design paradigm of the last couple of years. But as designers get tired of fake leather and torn paper, more and more are gravitating towards a flatter, almost minimalist aesthetic (Greif, 2012a) see Figure 3.

Figure 3: An example of bad Skeuomorphism use of gaudy textures

Recently companies have sprouted up trying to predict the new latest design trends but all were shocked when the next design movement to be spurred by Microsoft. Distancing itself from Skeuomorphism whilst emphasising a flat UI that is minimalist to the core (Carr, 2012). Whether to better differentiate themselves from apple of because they genuinely thought this was a better design, Microsoft embraced a completely different aesthetic (Greif, 2013). By Opposition to rise of Skeuomorphism the newly popular 'flat design' of which 'Microsoft's Metro UI' is probably the main example embraces visual minimalism, eschewing textures and lighting effects for simple shapes and flat colours, can be seen in Figure 4.

Figure 4: Microsoft's Metro UI operating system

Many designers have been calling the recent rise of Flat Design as a fad since early on (Moore, 2013), due to the recent backlash against Skeuomorphism. Much like not too long ago, designers working for the web were getting fed up with the irrational, ugly shortcuts being praised as good design (Yu, 2012). Flat design is both popular and controversial in the world of UI (Moore, 2013). As there is a shift going on, design wise creating a movement away from faux textures perhaps epitomized by the texturally rich designs of iOS, Mac OSX. What is going on is more than just a rejection of over the top Skeuomorphic textures; instead it is a very strong push in the opposite direction (Gruber, 2013). Even game UI's comprise detailed textures and elaborate shadows are showing signs of embracing minimalism.

It can be argued that the trend moving away from Skeuomorphism and visual textural metaphors can be said to be happening due to the rise of the retina display (increased resolution). The timing of this trend and the fact that iOS and the iPhone in particular is its leading edge of smartphone design is not coincidental (Gruber, 2013). Retina displays are no longer limited in way that requires the use of faux textures and effects to create beautiful UIs. The lack of Skeuomorphic effects and almost extreme flatness of the 'modern' windows 8 interface is remarkably forward thinking. It is meant to be

viewed on retina-calibre displays not the sub-retina displays it was originally released on with windows phone 7.x or a standard desktop computer display. All though these new flat styles of interface design can be visually stunning there seems to be a certain level of sterility to the design that prevents it from being endearing and lack an emotional connection with the user (Gruber, 2013).

The intensity with which flat design has been incorporated into UI design only comes to light after the market was already being saturated with faux Skeuomorphic textures (Peters, 2013). It seems that designers were bored of the previous trend, which is why we have ended up with a design model that takes thing in a completely opposite direction with no shadows, gradients or textures. It is key that whenever Flat Design is used it is because it is the best design solution to the problem and not that the designer is just trying to be different (Greif, 2012a), which can often be the case when young designers are trying to distinguish themselves from their colleagues. If it were a graphic design trend, it would be well received but web designers have to think about the usability of the design not just the aesthetical side due to the direct connection between their work and the user, because the user experience cannot be ignored, flat design is inherently flawed (Moore, 2013).

Flat design is based on the principles of completely stripping the interface of all the visual cues that our use to help us interact with our surroundings and everything appears on a 2D plane. It is the affordances created by using Skeuomorphism and they're traits and qualities of a given object that help us identify what it is we can do with it for example a knob affords twisting and a cord affords pulling. With reference to the metro UI shown in Figure 4 it may be noticed that the uncomfortable lack of shadows, highlights and all-around spatial awareness (Beshay, 2012). It is from the removal of these affordances that helps create the minimalistic design aesthetic that flat design utilises but taking this new minimalistic approach too far can have serious consequences on usability (Beshay, 2012). As when all the affordances of the design are removed it is harder for the user to know how to interact with the interface. When everything is on the same plane you make it harder to focus on a specific section of the page (Greif, 2012a).

Over recent years user have come to rely on these affordances that Skeuomorphic techniques create to guide their way through an interface; buttons have slight gradients and rounded corners. If you remove all of these clues and you end up with a flat design world where every element of the interface is suddenly placed on the same level that can potentially lead to confusion (Rudberg, 2013). Vision is one of the most important senses we use and is a direct link to the world we interact with. It is usually our eyes that can detect whether a given object can be interacted with and how to interact with is. Our eyes don't only pick up colour, they can detect light sources, degrees of shading and depth, it is these tools that allow us to navigate complicated UI with the use of certain affordances (Beshay, 2012).

Perceiving flat design as a singular tool in one's bag of tricks is a dead end too. One should never have to choose between flat design and something else. Good designers do not sit down and decide to do 'Flat Design' one day and 'Skeuomorphism' the next. Good designers design for context, utilizing all that they've learned and forming a response that is uniquely their own, not the fan base's (Peters, 2013). Down to the levels of user

experience and usability, Skeuomorphism and flat are disparate visual solutions, yes, but neither is a solution to the massive usability problem (Riley, 2013). The best solution usually lies somewhere in the middle. Compromise is hard for people with extreme opinions which is usually the case when arguing the cases for either Apple or Windows design, but it usually benefits the masses. In this case the masses are the users of our products. There is a way to take all the good things from flat design and Skeuomorphism / realism and apply them in a way that is still usable, even for highly complex interfaces (Moore, 2013).

With recent releases Google's new mobile apps, Google has started developing a style that some describe as 'almost flat' or maybe "skeuominimalism" which may be seen in Figure 5. This new style uses elements like shadows and gradients in a tasteful, subtle way. Skeuominimalistic design is simplified to the point where simplification does not affect usability and its Skeuomorphic affordances are maximized up to the point where it does not affect the simple beauty of minimalism (Sanchez, 2012).

Figure 5: Examples of new revamped Google Applications across a group of platforms.

For the most part these interfaces adhere to the flat design principles of flat colours, no drop shadows and user of colour to encourage specific user actions. But it doesn't ignore the concept of depth and shadows entirely and allows the user the necessary affordances to operate the interface. Instead, depth is used to support comprehension of the interface. But just like gradients, this can be done in a subtle way and still allow for the separation of information (Moore, 2013).

3   METHODOLOGY

There were two hundred and seventy four respondents to the online questionnaire from Loughborough Design School. Several steps were taken in the design of the questionnaire to ensure responses were reliable and relevant. Open-ended questions were avoided to ensure the data would not become too obfuscated with periphery information. The questionnaire method was chosen instead of interviews due to the large and diverse sample size of the participants. Nevertheless, the questionnaire was a quantitative research method, as opposed to qualitative and, as such, the information gathered was not in as great a detail as that of an interview. It was also acknowledged that often the participants may not always answer everything truthfully, particularly if the question seeks to determine if the participant displayed signs of addiction. It is interesting that a large number of the respondents to the questionnaire advised that they completed the questionnaire via internet access from their smartphone, as opposed to their computer or tablet.

3.1 Reliability and Validity of Research Methods

The online questionnaire was double-tested in a 'technical' manner and in the 'running' of the questionnaire as a whole. One of the primary criteria for the evaluation of this research tool is the demonstration of practical usefulness, including relevance, simplicity and ease of completion by the respondents. Lehtonen, Page, Thorsteinsson, and Hepburn (2007) devised a test based on the number of responses (response rate) to

the questionnaire in relation to the total number of invitees. A weak response rate was deemed to show less than fifteen percent response rate. A semi-strong response rate was one in the interval between sixteen to forty five percent. Finally a strong response rate was deemed to by fort six percent or above. This study fulfils the strong response rate as there were two hundred and seventy four responses from a total of five hundred and seventeen students invited to reply.

In this study, the research work underwent regular steering meetings where the research questions and the questionnaire was repeatedly reviewed and tested. A pilot was undertaken with fifteen students in order to refine the questions and categorisation of responses. The objectives of the steering meetings were to specify research project targets and supervise the research progress. Furthermore, it decided on publication of the results achieved during the project.

4 DISCUSSION OF RESULTS

All though these give a rough idea of what the respondents think about the topics discussed. It is now key that these results and are analysed so that we can see if the aims of the research project have been met. Of the respondents that were included in the questionnaire process, one hundred and seventy two were male and one hundred and two and female. It was essential to know the gender of the respondent to ensure that the research was gender biased and that both male and female respondents had the same reaction to Skeuomorphism in UI design throughout the results it was found that gender did not play a role in distinguishing between which method was preferred by the designers.

With regard to the question *'Are you familiar with Skeuomorphism in designing user interfaces?'* Of the respondents, eight two had a working familiarity with designing UIs with Skeuomorphism. Of this eighty two, sixty were final year students which showed that in years one and two there was a lack of knowledge around Skeuomorphism and UI design. It may be seen that the purpose of this paper on the topic is relevant as it is expected that it will be able to help young designers in expanding their knowledge of UI design and give them an improved perspective of the skillsets available to them to progress with.

With regard to the question *'After reading the information on Skeuomorphism and the rise of flat design do you feel there is still a place for Skeuomorphism in UI design?'*. Of the respondents, one hundred and nine said 'yes' and the rest replied 'no'. This was a surprising result, as it was believed that more people would have said 'yes' to Skeuomorphism. This shows that the student designers in general have a very minimalistic approach to UI design that lends itself to Flat Design. This goes hand-in-hand with the current design traits that can be seen in UI design with the increase of young designers being influenced by visual aids that they find when researching design influence for a project and listening too much to the opinions voiced on internet design blogs.

With regard to the question *'If faced with a UI design task which design style would you use?'*. Of the respondents, ninety six said 'Skeuomorphism', one hundred and sixty two said 'Flat Design' and sixteen said 'other'. Interestingly, is that the ninety six that said

they would use Skeuomorphism were from the group of one hundred and nine respondents that said they believe that there is a place for Skeuomorphism in UI design. This may be because they are influenced by Apple Design software and follow them down the same design style which is often the case with young designers as it showed that these people were in year's one and two. The one hundred and sixty two respondents that replied 'Flat Design' is influenced by current trends and opinions of many designers on the web the sixteen respondents that replied 'other' where from the final year showing that with age they have expanded their resources as a designer and are exploring other design ideas. This shows that age definitely has a fact when it comes to being influenced by design seen on a day-to-day basis.

With regard to the question '*After reading the insert on skeuominimalism if you did not before, do you now feel that Skeuomorphism has a place in UI design as a complimentary instead of a standalone tool*?'. Of the respondents, one hundred and eighty eight said 'Yes' and eighty six said 'No'. It may be inferred that after viewing the passage on Skeuominimalism that many respondents changed their opinions on the topic from a negative to a positive. This show that if they design tools are taught as a tool to help assist the design instead of a specific style in which to design that it can be much more beneficial to the designer and allow them to express their designs in the most appropriate way.

With regard to the question '*If you were now faced with a UI design task, which design tool would you use?*'. Of the respondents, eighteen said 'Skeuomorphism', forty two said 'Flat Design', two hundred and fourteen said 'Skeuominimalism' and no-one said 'Other'. It may be inferred that after learning about skeuominimalism and using a combination of flat design in conjunction with Skeuomorphism as design tools and applying them when relevant to their design has changed the opinion of the young designers that were questioned. It proves that some designers will stay true to the design styles they like but that the majority are interested in the tools that can produce the best design possible for the user.

With regard to the question '*After reading the research paper on Skeuomorphism and UI Design do you feel that it has improved your knowledge on this area of design and made you better equipped as a designer?'.* Of the respondents, no-one said 'strongly disagree', no-one said 'disagree', forty two said 'neutral', ninety eight said 'Agree' and one hundred and thirty four said 'Strongly Agree'. It may be inferred that the usefulness of Skeuomorphism in UI design has proved to be very useful to the younger designers involved in the process who had access to the information on the topics discussed. Furthermore, two hundred and thirty two agreed that it has made them better equipped as designers that more young designers should have access to this information on different design tools. It also reveals that instead of teaching specified design styles, which have to be adhered to that instead they should be taught as design tools which you can utilise when needed.

5   CONCLUSION

The first aim was to explore and discuss Skeuomorphism and to determine its futures in UI design. This aim was achieved through the rigorous research process that went into collating the information from a vast array of sources for the Literature review. The

questionnaire also allows young designers to express their opinions on the topic which allowed the results to be analysed to show the worth of the academic report and how it could be used to influence designer's choices for the better. The second aim was to use Flat Design and Skeuominimalism to give a wider perspective on the topic of Skeuomorphism. This was achieved again through the use of the Literature review which was then used as a tool during the questionnaire process to give additional information to the users before they can answer certain questions. The final aim of the research project was to help designers understand the areas of interface design and allow them to make a more informed decision when creating their own UIs. This can said to of been achieved by the results shown in the questionnaire as [Question 8] asked "After reading the research paper on Skeuomorphism and UI Design do you feel that it has improved your knowledge on this area of design and made you better equipped as a designer?" The results showed that 17 out of 20 respondents found the report useful, 3 found it neutral and didn't have an opinion about the topic afterwards. This could be said to be a phenomenal success and has equipped the designers with better skill set to UI design.

This research has given account of the many areas and design tools available for UI Design, looking at the wide spread use of Skeuomorphism and Flat Design with the upcoming rise of Skeuominimalism. This study was set out to determine if Skeuomorphism still had a place in UI design alongside the backlash of negative thoughts on the subject and increase of praise for Flat Design. It was also important that this project provided an insight into the topic for designers so that they could benefit from the research material gathered in devising content management systems to support mobile device learning.

This study has shown that not only did the participants find the information provided useful and beneficial to them developing further skills in design but also that when discussed in length and shown with visual aids that Skeuomorphism does have a place in UI design but only through the use of skeuominimalism. The respondents stated that the majority of them would not use skeuominimalism as a stand-alone process to design with and would prefer to use the minimalistic approach of Flat design. But when the idea of combining both Skeuomorphic and minimalistic elements in conjunction with each other to get the best out of the design it could be very useful and that the majority of them would choose to use such a technique when designing their own UI. This provides a methodology for the development of learning objects in mobile design education.

The results of this research support the idea that Skeuomorphism does in fact have a place in UI design but just not as a stand-alone feature but instead one element of the design. In general it seems that the way in which these topics are being viewed is incorrect and is creating false opinions on the topic. This provides an enabling technology for developing tools and creating learning communities.

REFERENCES

Baranuik, C. (2012). How We Started Calling Visual Metaphors "Skeuomorphs" and Why the Debate over Apple's Interface Design is a Mess. 13/11/2012. Available at: How We

Started Calling Visual Metaphors ?Skeuomorphs? and Why the Debate over Apple?s Interface Design is a Mess [Accessed March 1, 2013].

Basalla, G. (1988). *The evolution of Technology G.* Basalla, ed., Cambridge: Cambridge University Press.

Beshay, K. (2012). Why I'm No Metrosexual. 12/03/2012. Available at: http://kyrobeshay.com/post/37101801643/why-im-no-metrosexual [Accessed January 4, 2013].

Brajnik, G., Yesilada, Y. and Harper, S. (2011) The Expertise Effect on Web Accessibility Evaluation Methods. *In Human Computer Interaction, 26 (3) pp.* 246-283.

Carr, A. (2012). Will Apple's Tacky Software-Design Philosophy Cause A Revolt? 2012. Available at: http://www.fastcodesign.com/1670760/will-apples-tacky-software-design-philosophy-cause-a-revolt [Accessed December 28, 2012].

Cyr, D., Head, M. and Larios H. (2010) Colour appeal in website design within and across cultures: a multi-method evaluation. *International Journal of Human–Computer Studies, 68 (2010), pp.* 1–21.

Downer, C. (2012). Skeuomorphism and the UI. 22/11/2012. Available at: http://realmacsoftware.com/blog/skeuomorphism-and-the-user-interface [Accessed February 24, 2013].

Durix, J.-P. (1998) *Mimesis, genres and post-colonial discourse: Deconstructing magic realism 1st edn.* J.-P. Durix, ed., New York: St. Martin's Press.

Gessler, N. (1998). *Skeuomorphs and Cultural Algorithms N. Gessler, ed.,* California: 11152 Lucerne Avenue.

Greif, S. (2013). Flat Pixels: The Battle Between Flat Design & Skeuomorphism. 2013. Available at: http://sachagreif.com/flat-pixels/ [Accessed March 12, 2013].

Greif, S., 2012a. The Flat Sink. 26/12/2012. Available at: http://sachagreif.com/the-flat-sink/ [Accessed January 7, 2013].

Greif, S. (2012b). What Skeuomorphism Is (And Isn't). 2012. Available at: http://sachagreif.com/what-skeuomorphism-is-and-isnt/ [Accessed September 12, 2012].

Gruber, J. (2013). The Trend Against Skeuomorphic Textures and Effects in UI Design. 18/01/2013. Available at: http://daringfireball.net/2013/01/the_trend_against_skeuomorphism [Accessed January 18, 2013].

Hashimoto, A. and Clayton, M. (2009) Visual Design Fundamentals: A Digital Approach Charles River Media (2009).

Hobbs, T. (2013). Can we please move past apples silly faux real UI's. 2013. Available at: http://www.fastcodesign.com/1669879/can-we-please-move-past-apples-silly-faux-real-uis [Accessed February 7, 2013].

Hollan, J.D. (2010) Multiscale zooming interfaces: a brief personal perspective on the design of cognitively convivial interaction. *In Interactions, 17 (6) pp.* 71-74.

Hooten, E.R., Hayes, S.T. and Adams J.A. (2013) Communicative modalities for mobile device interaction *International Journal of Human-Computer Studies 71(10), pp.* 988-1002.

Kelly, M. (1998). *Encyclopedia of Aesthetics, Volume 3 Illustrate. M. Kelly, ed.*, London: Oxford Univerity Press.

Knappett, C., 2002. *Photographs, Skeuomorphs and Marionettes, no.7,* pp.97–177.

Lehtonen, M., Page, T., Thorsteinsson, G. & Hepburn, M. (2007) An Application of a Virtual learning Environment in Support of Teaching and Learning for Design and Technology Education, *International Journal of Learning Technology, 3(2), 2007, pp.*133-151.

Moore, M. (2013). Almost Flat Design. 23/01/2013. Available at: http://www.matthewmooredesign.com/almost-flat-design/ [Accessed February 5, 2013].

Norman, D. (1988). *The Design of Everyday Things.* New York: Basic Books. ISBN 978-0-465-06710-7.

Odom, W., Blevis, E. and Stolterman, E.A. (2008) Personal Inventories in the Context of Sustainability & Interaction Design. *In ACM Interactions, 0 (5) pp.* 16-20.

Peters, C. (2013). Flatliners. 23/01/2013. Available at: http://colepeters.com/flatliners/ [Accessed January 23, 2013].

Riley, W. (2013). Less Aesthetic, More design. 24/01/2013. Available at: http://blog.wells.ee/less-aesthetic-more-design [Accessed February 24, 2013].

Rudberg, M. (2013). Flat UI is not the only way forward. 20/01/2013. Available at: http://blog.maxrudberg.com/post/41005209081/flat-ui-is-not-the-only-way-forward [Accessed January 7, 2013].

Sanchez, E. (2012). Skeuominimalism - The Best of Both Worlds. 15/10/2012. Available at: http://edwardsanchez.me/blog/13568587 [Accessed February 5, 2013].

Wulf, C. & Gebauer, G., (1995a). *Mimesis: culture, art, society 1st edn.* Christopher Wulf, ed., London: University of Calfornia Press.

Wulf, C. & Gebauer, G., (1995b). *Mimesis: culture, art, society 1st edn.* Christoph Wulf, ed., London: University of Calfornia Press.

www.theverge.com. (2013). Redesigning Google: how Larry Page engineered a beautiful revolution. 24/01/2013. Available at: http://www.theverge.com/2013/1/24/3904134/google-redesign-how-larry-page-engineered-beautiful-revolution [Accessed February 5, 2013].

Yu, A. (2012). The Flat Design Era. 25/09/2012. Available at: http://layervault.tumblr.com/post/32267022219/flat-interface-design [Accessed January 3, 2013].

Ziefle, M. and Bay, S. (2006) How to overcome disorientation in mobile phone menus: A comparison of two different types of navigation aids. *Human Computer Interaction, 21 (4) pp.* 393-432.
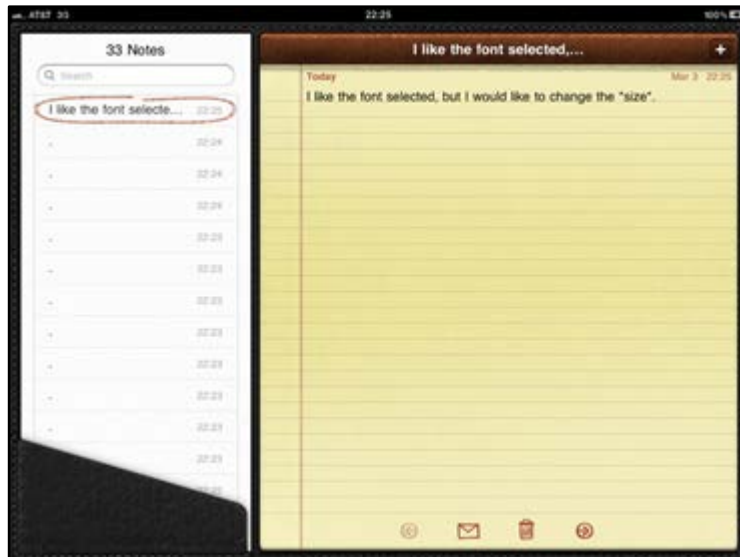
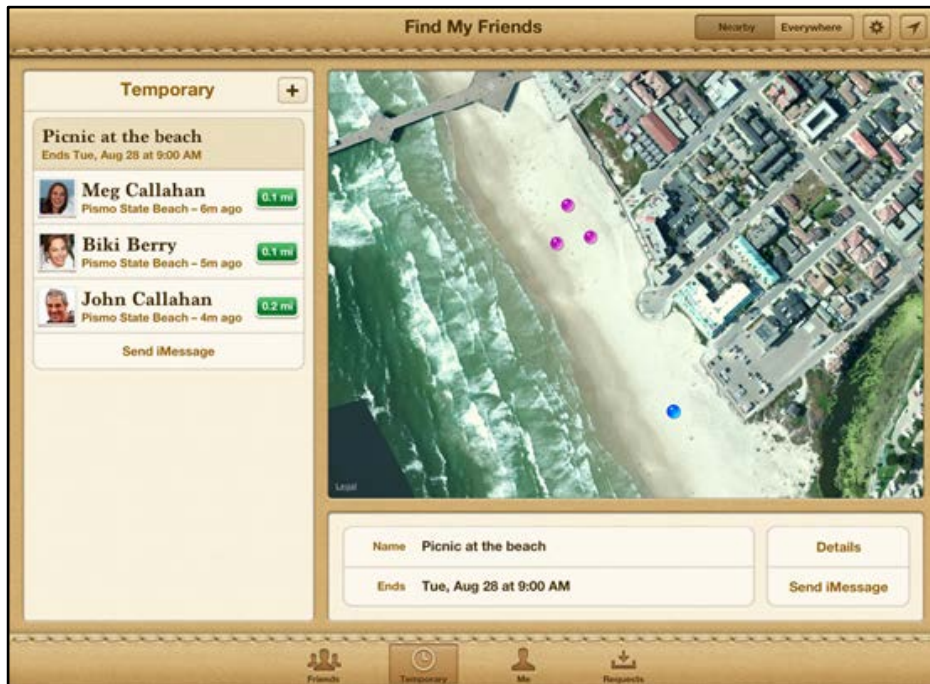Figure 1: Example of a digital skeuomorph - Apple Notes Application

Figure 2: 'Find my Friend' App UI.

Figure 3: An example of bad Skeuomorphism use of gaudy textures

Figure 4: Microsoft's Metro UI operating system

Figure 5: Examples of new revamped Google Applications across a group of platforms.