Psychology of UX

Ever since I found the blog 'What Makes Them Click' [1] by Susan Weinschenk, I've been fascinated with her writing. I'm a natural analyst, much to some people's dismay, as I mentally poke and prod people till I really understand what drives people to behave the way they do. This has led me to study Product Design, Anthropology and to now be employed in the UX industry in an attempt to understand people and better their human experience. So when I read Susan's post on 'The Psychologist's View of UX Design' [2], I was fully engrossed in what she had to say on the matter.

Her article broke down several areas of study relating to the brain, memory and the visual systems in humans to explain how these are relevant to UX. I will break down Susan's post and further explain my understanding of each of her ten points and what this has meant to my experience of UX thus far or the direction I'd like to take my own UX practices within a professional environment.

10 Things to About Human Psychology That Should Inform UX Design

1. People Don't Want to Work or Think More Than They Have To
2. People Have Limitations
3. People Make Mistakes
4. Human Memory is Complicated
5. People are Social
6. People are Easily Distracted
7. People Crave Information
8. Most Mental Processing is Unconscious
9. People Create Mental Models
10. People Understand Visual Systems

1. People don't want to think or work more than they have to. Firstly, I don't think many people are going to debate this point if they are really honest with themselves. I'm not arguing that we can't all have bursts of motivation and be hard-workers, but *ultimately* we are all lazy (or 'efficient' as Susan puts it).

And there's a very good reason for that. Throughout our evolution, we've managed to survive longer if we successfully conserved our energy. This means that we would focus on exerting the least amount of energy possible to attain our core needs (water, food, sex, shelter and protection against danger/threat) as we couldn't be certain where our next meal was coming from and if we'd have a calorie shortage.

Today that's clearly not the situation with food in every corner shop, but the behaviour is still ingrained in our genes and we can't shake it off easily. If we take the example of hard-workers who may contest that they are not lazy, the fundamental reason for their effort to climb up the career ladder is money which equates to being able to purchase our core needs (water, food, sex, shelter and protection against danger), so perhaps being a career-person is the laziest choice for attaining those essentials (rather than say building a house for yourself, digging a well to get water or hunting a caribou for hours).

So now that we've established the idea that people are all ultimately lazy...

Let's explore some examples of how people are lazy on the World Wide Web. Susan references Steve Krug's book, Don't Make Me Think [3], where he states that 'people typically glance at websites and scan the content, clicking whatever they first see that catches their interest or vaguely resembles what they are looking for, rather than reading the whole page.'
Absolutely. You know it! I'm sure you've been to a badly designed website before where you get to it, there is a plethora of text bombarding your eyes, you get overwhelmed and quickly scan for a word that relates to what you are looking for and starting clicking away. A few clicks forward, a few clicks back and you are horribly lost. You leave the website. This approach happens with not-so-badly designed websites as well though hopefully you will find the content you are looking for on these in a short amount of time.

People like short cuts (a faster way of doing something). Particularly if they have to do the task over and over. This is just another way to conserve energy through using your mind to find a lazy-friendly approach. However, interestingly, Susan points out that if it takes too long or too much effort for you to discover the short cut, people will default to the tedious, lengthy approach. In other words, we can be lazy about finding a solution that will allow us to be even lazier. Ha!

A few web examples of short cuts might be when you are filling in a form, you might copy and paste data (such as your email), or have auto-complete fill it in for you. Similarly rather than remembering all of your passwords you may use a password-storage system in your browser that also auto-saves your passwords for you. However if initiating these services is too confusing to find, you may just take the extra time to type out your email address twice in a row or rattle off 5 passwords before you find the right one.

In the same vein, the term 'satisficing' was coined by Herbert Simon [4] that combines the words 'satisfy' and 'suffice'. The formal definition for 'satisficing' is a decision-making strategy that attempts to meet criteria for adequacy, rather than to identify an optimal solution. As we do not possess the cognitive ability to weigh all the options, we settle for what is good enough rather than waste the energy trying to identify the best solution.

A web example of this could be when you are searching on Google - rather than go through the extensive pagination to find the *perfect* answer to your query, you are likely to settle for some item on the first three or four pages.

So those are a few examples of people's laziness factor, but... **How can we consider this when designing the UX of websites?** Simple: allow people to do as little as they have to (including thought) to achieve the desired outcome on your website.

For instance you could:

- Make your website more scannable by using **less text and adding more imagery** (as humans are 90% visual creatures).
- Bouncing off the point above, **show examples** or explanations through imagery rather than text.
- Create **clear and visible** navigation with wording that is familiar (i.e., don't be overly imaginative with your wording as it can confuse people who are used to web standards like 'home' and 'contact'. But that also doesn't mean you should talk like you are a computer in crazy code "Error 3.106 is faulty because of PHP.zipfile corruption 27695..." You get the point :)
- **Provide defaults and short cuts** that cater to common work flows. For example, if you are creating a email website, make the buttons/access to the area where you 'compose' an email or 'read' emails dominant over other less important tasks.
- **Make things that are clickable, look clickable** [5] and things that aren't, not. For instance, make links have underlines or different states when hovered over.
- **Don't overcrowd your website** with content. Give people a little bit of information and then offer the opportunity to learn more through subsequent clicks.[6]
- And most importantly, find out your users' true needs so you don't overcrowd the website with unnecessary functions, content and clutter. Design for their desired needs and work flows only!
2. People Have Limitations. If you are multi-tasking while reading this article, please stop! I need your full attention. Seriously. Let's find out why.

Multi-tasking is a modern trend where we try to mentally manage two or more tasks simultaneously with the (erroneous) belief that we are optimizing productivity. For instance, you might be at work checking your emails, while also filling in an excel spreadsheet, reading the news, chatting to your co-worker about internal changes, drinking a cup of tea, and browsing some websites to gather research for a presentation you are putting together—all at the same time. This might be a typical work day for most people.

At home, media saturates the multi-tasking experience even more with people often watching TV while browsing numerous websites on their laptop and texting a friend on their phone. This kind of behavior has become so commonplace in our society today that most people would agree they do this, and most would also defend their ability to manage multiple things going on at the same time. But they'd be wrong.

Don't believe me? Try this experiment. Think about the taste of chocolate while you mentally add 38 and 272. Mmm, 310 is my new favourite flavour! No, but in all seriousness, you couldn't do it. It's impossible.

The origin ...of the word itself helps us understand how far removed this method of operating is from the way the human mind works. In fact, the term 'multi-tasking' came about from the computing industry back in the 1960's to refer to the ability of a microprocessor to process several tasks at the same time. It wasn't until 1998 (only 13 years ago) that humans started adapting the word to themselves. So in retrospect it is a very new concept and an even newer practice for human beings to be undertaking.

But what about historically speaking? Did our ancestors multi-task without knowing they were "multi-tasking"? Sure. Human beings have always had the capacity to handle several things at once since the time of hunter-gatherers. Mothers would pick berries while feeding their infants, or preparing food while keeping an eye on their children.

Men would have had complex, long hunts where they had to have mental maps of where their buddies were in hiding to optimize their approach in hunting the animal, simultaneously remaining quiet, exploring the land with their feet to ensure stability and preparing to attack. Because of this need, we developed part of our brain known casually as 'the executive system' and officially as 'the prefrontal cortex'.

This front lobe of your brain conducts your focus by helping you ignore distractions and switch from task to task. But nowadays it seems our assuredness in our ability has surpassed the ability itself. You might have experienced this if you ever have tried to type a message to a friend on a computer while someone else talks to you in person. Your mind tunes out the voice and while you can pretend you are paying attention, you will most likely have to ask them to repeat themselves.

The way the prefrontal lobe works is that it can only process one thing at a time, but it can switch between two tasks very rapidly. You can do more than one thing seemingly at the same time, but in reality you are ordering them and deciding which to do at that specific time. However the negative side to switching from task back and forth again and again is that it takes about one minute to recover our train of thought, breaking our concentration and making us unfocused. For full concentration on one task to be re-established, it can take fifteen minutes! In this mode we are only capable of superficially scraping the surface. This in turn is more counter-productive than anything else.

"The general understanding people have of multi-tasking is a bit of a misnomer. I've never seen any examples of anyone who can do three or even two intelligent tasks simultaneously," says neuropsychologist Prof Laws
Nowadays the speed and amount that we multi-task has exploded due to technology. **Software often requires us to think about multiple things at the same time.** For instance, if the predictive text feature on your mobile phone is correctly amending what you are writing as you write it, you are forced to pay attention to two very similar tasks. And if the tasks are too similar they compete for the same space in the brain, and you mentally can NOT focus on both at the same time. Yet if one task is something more automatic or highly practised like walking or breathing, we can do another conscious task simultaneously as we require very little processing to perform the first function.

**So why should we care?** Multi-tasking is very popular these days. It hints at productivity. It seemingly allows us to split our attention (most likely from one or more things we *don't* want to do.... and potentially another we do – like watching TV while you do your homework). This makes the work become less tedious. While this practice can be easy to fall into, we should avoid it as it will take us longer to accomplish any one task, not to mention the quality will most likely fail.

Even more importantly, the brain needs time to recover between switching between tasks to gather its thoughts. Without this time, the individual will be over stimulated and quickly become stressed out with all of the effort they are giving to multiple tasks. Too much multi-tasking can condition the brain to an overexcited state which makes it hard to focus even when you want to. This makes for unhappy, unproductive and exhausted workers. Do you really want that?

**How can we overcome this?** Well, the honest answer is: we can't.

"*With such complicated tasks [you] will never, ever be able to overcome the inherent limitations in the brain for processing information during multitasking. It just can't be, any more than the best of all humans will ever be able to run a one-minute mile,*" says David E. Meyer, director of the Brain, Cognition and Action Laboratory at the University of Michigan

We should respect the way our mind works and work in a similar fashion. From a UX perspective, we can design software, websites and all digital interfaces to **minimize distraction and focus the user's attention onto one task at a time.** This means you can't have all the tools in the toolbox in front of you when you work. We can give our users more of a holding hand as they are guided through a clear workflow that helps them accomplish one task, and THEN another... and another. One at a time, considering what communication and information is really worthy of interrupting your precious concentration and when you should seek out new data.

At my company, we are really starting to consider ways that we can incorporate this approach of one task at a time into our designs so that our users won't be as overwhelmed with the amount of data available to them. The financial world seems to LOVE throwing every single piece of data onto every possible screen they can, which must overwhelm users of these systems immensely. While seemingly giving the user a feeling of power with all of this information at their fingertips (this is the upcoming topic for The Psychology of UX: Part 7 coincidentally), realistically they are only able to focus on one item at a time, flitting from one to another to another to another to another, trying to remember what they were thinking just a second ago. Are you exhausted yet? I am.

**One way we can 'trick' our mental system though...** is to multi-task tasks that don't share attentional resources, i.e. use different sensory inputs. Like visual and auditory, which can work together without interfering at times. One really cool example we found of this was a chart that has supporting sounds to reinforce the direction of movement of the graph, which helps reinforce understanding. Check it out for yourselves! [7] Imagine the potential for tapping into our user's various senses to help them quickly understand what they are seeing, as well as helping them focus, and in turn be more productive.
Simplifying a user's workflow ...and the maximum things they can do at one time, teamed with tapping into our various sensory systems may be the key to creating interfaces that are designed with the user in mind: a human being, not a microprocessor. Mono-tasking should be the new multi-tasking. Spread the word.

I attempted to multi-task when writing this part of the article for the irony and it took me four days of occasionally writing a sentence before I got fed up. On the final day when I decided to mono-task (it'll catch on 😊) I managed to compile this in an hour or so. Proof, it works!

3. People Make Mistakes. What exactly is a mistake? "...a decision or action, or lack thereof, that we fear we'll come to regret. They usually cause some degree of pain, loss or struggle," says Mel Schwartz from Psychology of Today. [8] For a more software-based explanation we might say a mistake is simply something that is wrong or that causes a problem with a user's normal workflow.

Yes, mistakes. We all make them. We wish we hadn't. One snooze button too many. Spending money on things we shouldn't. Having that extra cocktail at work drinks and breaking out your embarrassing dance moves....I'm divulging too much of my personal life. But what about mistakes in the digital world? What happens when a user makes a mistake on a computer? These are things we will cover in today's post.

'Assume people will make mistakes. Anticipate what they will be and try to prevent them.'

Susan Weinschenk stated the above in her 'Psychologist's View of UX' post, the inspiration for this article.

Why would we want to prevent them though? Well aside from mistakes causing users great frustration and pain when interacting with a system, mistakes can be rather costly, particularly in the financial sector where a user might be trading thousands, or even millions, of dollars with one click. It's imperative when designing the user experience for financial interfaces to make the workflow easy-to-use and error-free.

So how do we prevent errors? The best error message is no error message. What this means is that a system that is designed well will not allow the user to make an error to begin with. The main way we can accomplish this is by predicting what mistakes a user might make, based on knowledge gathered by researching the environment they operate in and their needs with the system. We can then adapt our designs accordingly to avoid allowing those mistakes to be made in the system.

If the task the user will be conducting is very complex or error-prone, a further approach is to break up the task into smaller steps so that each step can act as a quality gate before the user is allowed to move onto the next. We often see this design solution in online payment portals on retail websites, like Amazon.

How do we treat errors in the system?

Can you read that? Honestly? Even you developers out there (who often are the ones who have the mission of writing these error messages). You are human too - we don't talk like that. The first crucial step to dealing with errors in a system is speak in human language! Explain that an error has occurred, what the error is, how the user can correct it and where they can go for more help to fix it. In plain language. When something goes wrong in a system, it's of the highest importance that the user knows what to do about it.
The below image is great examples of clear, human language communicating to the user the problem with visual cues (symbols and colours) and sometimes even contextual hints as to where the problem went wrong (i.e. a highlighted password field when the password is wrong).

We should also allow users to UNDO actions, such as mistakes they have just made. Ctrl-Z, anyone? It's been a godsend for me. Users need autonomy within a system and this can only be achieved if the system is so well designed that the user can't get so lost down a path they can't find their way back to where they were. Allow them to undo and reverse steps. Similarly the 'ESC' key can be used to exit a curtain task that isn't yet completed, to prevent the damage from being done.

In reality, it is near impossible to create a completely error-free system that guarantees the users won't make mistakes. But why?

**Because people make mistakes and UX Designers are just people.** "If Ernest Hemingway, James Mitchener, Neil Simon, Frank Lloyd Wright and Pablo Picasso could not get it right the first time, what makes you think that you will?" - Paul Heckel

Without sturdy user research, the designer will have a lack of knowledge of the user needs and this can result in an unusable design. That's why we as designers need more time. More time for research with the users and more time for testing with the users.

At a 'Lean UX' workshop I went to last weekend Janice Fraser, one of the founders of the famous Adaptive Path UX consultancy, said rather powerfully in regards to the Agile methodology,

"Don't throw the design out into the world and hope it works. I no longer want that responsibility. We are supposed to get it right the first time, yet the developers get to do it over and over again."

UX Designers need the allowance of time and budget to be able to test our prototypes on real users before the designs are fully coded and completed for product release. That's not to say that a design shouldn't be coded to test if it's implementable or to test the functioning prototype on a user, but we need time to test the designs before they are finalized.

That way we can see what errors the user might run into or what errors are prevalent in your design. And then we can iterate and improve on our designs.
Not enough time? "The joy of an early release lasts but a moment. The frustration of an unusable system lasts forever."

Let's do it right, step by step, and try to design a system that is *mostly* error-free.

4. Human Memory is Complicated. "Memory is deceptive because it is colored by today's events." - Albert Einstein

So what is memory? Memory in its most basic definition is the ability to encode, store, and retrieve information and experiences. It is essential to our lives. We rely on memory to help us remember our identity and that of others, our past experiences, and potential threats.

How does it work? There are three memory systems: Sensory, Short Term, and Long Term.

All of the time, our five senses are taking in a surplus of environmental stimuli, filtering it, and discarding irrelevant information. When the stimulus has ended and an impression remains, it is temporarily recorded in our minds. This is known as Sensory Memory. It often happens unconsciously and only lasts split seconds.

Our mind then goes through two processes to get the information from Sensory Memory to Short Term Memory. The first process is **pattern recognition**, where we actively search through our Long Term Memory to find a matching pattern for the new raw data. The second process involves **focusing our attention on the stimulus** until it moves into our **Short Term Memory** where it is encoded primarily acoustically and occasionally visually.

Our Short Term Memory typically **only lasts 30 seconds and has limited capacity** to store information because it all occurs in the frontal lobe of our brain. You remember the prefrontal lobe from my previous post, don't you?

There is no definite number to how many items we can store in our STM at once. One famous theory suggested there was a capacity of 7 plus or minus 2, but this has been disproved [9] and is now suggested to be even lower. By `'chunking' information into meaningful groups` (think telephone numbers remembered in groups of 3's or 4's) we can optimize the "space" in our STM.

After we have stored the information temporarily in our STM we can encode the information semantically by **creating mental associations and with frequent rehearsal** in our **Long Term Memory** which is spread all throughout the brain in our neural connections.
The final act our memory performs is **retrieval**, where we pull the memory out of storage and **reverse the process of encoding**. But this isn't always a straightforward process...

**Distorted Memory.** "The process of remembering involves the retrieval of information which has been unknowingly altered in order that it is compatible with pre-existing knowledge." -Neurophilosophy

Let's look at one study specific to Short Term Memory that demonstrates how our memory often fails us:

"In a study conducted by Intons-Peterson et. al (3), both younger and older adults were asked to remember the following list: candy, sour, sugar, bitter, good, taste, tooth, nice, honey, soda, chocolate, heart, cake, eat, and pie. They were then asked to take a minute to write down all remembered words. The next test entailed that subjects consider the words taste, point, sweet and identify which word was included in the original list. **An overwhelming 80-90% of participants confidently, but incorrectly, selected the word sweet.** While the word sweet yields a close association to the presented collective of words, this association should not nullify the fact that its selection still results in a memory malfunction. ....Incidents such as these are frightening reminders of the memory's fallibility."

Yes, our memory can be deceptive and as Daniel L. Schacter, a Harvard psychologist, explains in his renowned book 'The Seven Sins of Memory' [10] it is deceptive in seven distinct ways:

1. **Transience**
2. Absent-mindedness
3. Blocking
4. **Suggestibility**
5. Bias
6. Persistence
7. **Misattribution**

But I'll only focus on the ones particularly relevant to the web:

**Transience.** The weakening or loss of memory over time, regardless of age. For instance, you might clearly remember what background you chose for your MySpace profile back in 2001, but now it is (fortunately) a vague memory. "I'm pretty sure it was pink and had dancing stars with anime kitten faces on them...."

**Suggestibility.** Information that is inaccurately added to memories due to leading questions and suggestion. This commonly happens to eyewitnesses to crimes being repeatedly interviewed as their stories change based on the questions, but can also happen during the interview stages of UX research with SMEs and users. "So would the best solution be something like an Apple product interface?"

**Bias.** The editing or rewriting of past memories skewed by our current knowledge and beliefs. "I always knew online dating would become mainstream."

**Misattribution.** Assigning a memory to the wrong source or context. For instance, saying "I heard on the news the other night that Farmville was responsible for brain cell depletion in its regular users." when actually you read it on Twitter.

**But how does this affect UX design?** All of the above 'sins' of memory are particularly relevant to the user research stage. When one conducts interviews with SMEs or users, they need to take what is said with a pinch of salt: "self-reporting" is often inconsistent due to the fact that memories are not as accurate as we'd like to think they are. In addition, if the user or SME hasn't used a similar system in a long time, their memory may have decayed. Memories we don't use are erased from our Long Term Memory.
In another study by Sir Frederick Bartlett, a 20th century British psychologist, he asked subjects to read a Native American folktale and re-tell the story several times throughout the course of a year.

What he discovered was that the subjects **reconstructed the tale to fit with their personal biases** and beliefs:

"Participants omitted information they regarded as irrelevant, changed the emphasis to points they considered to be significant, and rationalized the parts that did not make sense, to make the story more comprehensible to themselves. In other words, memory is reconstructive rather than reproductive." – Neurophilosophy

As we can see, it's almost to be expected that human memory will err. This is why it is so, so, so crucial to **conduct observational user research** in place of (or in addition to) user interviews. In short, **watch what they do, not what they say!** Remember that 😊

During the design phase, we should also pay attention to the 'Seven Sins of Memory'. With Short Term Memory only lasting 30 seconds at best, a conscientious interface would **ensure that the users will not have to remember every step in a task flow**, but will be guided easily through it.

In addition, the limited capacity for STM implies we should not **bombard users with a surplus of information all at once** that they will never be able to focus on and remember for more than a few seconds. Designs should **direct the users' attention to the task at hand**.

With visual design tools like **distinctiveness** (making information stand out), **primacy** (important information first), **frequency** (information repeated as needed), and **associations** (positioning information/objects to suggest relationships- think 'chunking') we can help our users store more information in their Sensory and Short Term Memory. This will ultimately help them more **effectively navigate our system and pinpoint key information they need to remember**.

One final thought on an approach to making the system more user-friendly: **maintaining consistency** throughout navigation menus and with interaction patterns means that **the user only has to program their mind once** to this behaviour.

"If we remembered everything, we would have too much information to sift through to find the important things that affect our livelihood."

So now that you've finished reading this section, read it again. Over and over, until your mind can recite its key points and hopefully then it will be encoded for Long Term Memory. ;) 

5. **People are Social**

Humans beings are social animals. We are fundamentally driven by the need to belong and to have the approval of our peers. This urge to connect is at our core because of its ability to raise our chances of survival. When we act in accordance with the beliefs, suggestions and commands of the collective, it helps us to reach our goals, including the most primal of sustenance and shelter. Since the nomadic times, when we began hunting in our immediate families we quickly learned that joining forces and hunting together in larger groups meant bigger kills and greater chances of avoiding hunger.

"Humans are social animals and the urge to connect is basic survival, practically, emotionally, and genetically." - Pamela Rutledge, Ph.D.

For over 100,000 years, we have traded and exchanged between groups in order to draw upon other's specialization and raise each other's living standards.
We all know little bits of information, but none of us know everything.

Through exchange, we’ve surpassed our own knowledge, creating the ability for us to do things that we (individually) can’t even comprehend. For instance, we all know what a toaster is… but how many of us can fashion one entirely on our own? We’d need to know how to drill for oil, how to make plastic, how to wire electrics, how to create heating elements, how to create screws, how to extract and melt metal, and the list goes on.

In order for humanity to evolve, it's not important how intelligent the individual is, but how well we communicate and cooperate as a people. By evolving to communicate and have language, we became even more connected and increased our chances of survival.

We could warn each other of danger, guide each other and share wisdom. But with this ability to speak, also came the need to be heard.

Humans want to be heard …in order to share emotions and ideas, and to have these emotions and ideas validated. We look for guidance from others on what we should do and how we should act. This has always been and will always be the case.

"It's a basic element of humanity to want to be heard. Communication has evolved to where it is today because people fundamentally want to communicate. And not just communicate for its own sake, but to be heard and validated. If that weren't the case we wouldn't have Twitter and Facebook."-Brad Waters, Psychology Today

Another way that we learned to cooperate was through imitation. When we observe someone doing an activity, our brain has 'mirror neurons' that mimic the activity as if we were doing it ourselves. Through this imitation we quickly learn new skills and behaviors, from birth all the way through adulthood.

Humans are undoubtedly social beings and because of this we will always use technology to be social as a form of self-expression. If we look at the history of the internet, we can see how this happened as the internet itself was intended for military purposes but evolved to connect the world socially. Since its birth, this happened over and over again, from IRC to BBS systems to SixDegrees and Friendster and Myspace; to Geocities, LinkedIn, StumbleUpon, Flickr and Facebook. We have adapted the internet to speak our language; a language of interconnectedness and sharing.

Today, nearly four out of five web users visits a social networking site on a monthly basis. Twitter estimates that it has at least 325 million users every 24 hours. Facebook claims that its users spend over 700 billion minutes on the site each month.

We communicate online. We share online. And we look for guidance online. With regards to the last one, we can see this brilliantly demonstrated with something called 'The Amazon Effect', or 'people-powered product research'. 'The Amazon Effect' is a pattern where internet shoppers commonly go to Amazon.com first, often skipping the content written by Amazon to scroll down to the user reviews.

"I already know what it's going to say, it's going to tell me how great their product is. Why would I need to read that? If I want to know the truth, I have to read what other people like me thought about it. “ -'Designing for the Social Web', Josh Porter

Users look at other people's experiences with the product and find guidance on whether or not to invest in it themselves, thus learning from our shared experiences and knowledge.
But how does all of this affect UX? From the initial stages of the UX research, we can see the importance of user observation based on our skill of mimicry. By observing a user in person, our brains imitate their actions allowing us to better comprehend the activities they partake in. This strengthens our understanding of their needs and task flows, and allows us to create solutions with greater empathy and clarity of the problem.

When it comes to designing the UX, we need to take into consideration the necessity for a social outlet within our website or application. Allow for greater social interconnectedness in your designs so that people can go to each other for guidance and advice within your application, such as with ratings, reviews, news and forums. Allow users to forge helpful relationships, be it with similar users or with customer support. Give people an awareness of the size of the community they operate in to give them a sense of belonging as well as the choice of where they want to fit in within the community by establishing their profile.

Social Nature Brings Innovation Thanks to the social nature of humans and all of the connections people have been making through the use of technology, we have invented and evolved more tools in the past 100 years, than we did in a million years back in our hunter-gatherer days with the design evolution of our hand tools.

Today everyone is able to have their ideas and allow them to be shared on a global scale. It is because of this that we as a people are accelerating our rate of innovation, and we should encourage this in every way we can.

...So don't feel too bad if your boss catches you on Facebook at work. Tell him/her you are satisfying a core human need.

The second part of this article has been published in the Winter 2011 issue of Methods & Tools.

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The Psychology of UX - Part 2

Welcome back to The Psychology of UX series! This article continues to discuss the "10 Things to About Human Psychology That Should Inform UX Design" proposed by Susan Weinschenk. The first part of this article was published in the Fall 2011 issue of Methods & Tools.

6. People are Easily Distracted. How do you get someone’s attention? What do people notice? What distracts people? These are some of the questions we’ll be exploring. Let’s get started.
People pay attention to anything new and different, particularly movement. If you think back to our Paleolithic days, we needed to be survivalists. Any movements around us could be potential threats and we had to be alert and aware in order to exist. Similarly, our "old brain" (the first part of our brain to evolve) uncontrollably notices danger, food and sex. It may seem quite brute by today’s standards, but once again it’s all about survival. We need to eat, we need to procreate, and we need to protect ourselves so that we can continue to do those things.

But what does this mean in regards to design? *When appropriate*, placement of images of food, attractive people or potential danger/violence will focus our attention quickly on that area of the page. If this is suitable to your design aims, then by all means quickly grab the attention of the old brain. However this has been abused in recent times with companies trying to get easy looks with cheap usage of these types of imagery. My favourite example of this is a company called ‘Nila Foods’, who without any restraint apply gratuitous imagery to their trucks. But hey, it worked or I wouldn’t remember their name!

We notice faces. The second most common thing that people pay attention to is faces. We can’t help but look at faces. Be it because we wanted to see another person’s emotions to develop relationships or to look for potential threats, faces capture and keep our attention; so much so that our focus will remain on the same part of the page even after the face has disappeared. When humans look at faces, we tend to look at the eyes first, so showing an image of a person looking directly into the camera is most powerful. Similarly, if we see the person in the photo looking in the direction of something, we’ll look in the same direction. Usability specialist, James Breeze’s screenshot of an eye-tracking experiment demonstrates this perfectly:

Use the senses to grab our attention. As we are limited to the visual and auditory senses with computers, we should attract those two senses using colour, size, relationship/position, noise and animation. If an entire site is designed in gentle shades of blues and then you place a bright red button in the middle, it’s going to get attention. Similarly if you reading an article on a website, your eyes will most likely scan large headings, quotes and bold text more than the body of the text. We notice anything different. Why do you think I bold specific words in my blog posts so often?

However since people are easily distracted, DON’T use lots of sensory imagery and advertisements all over your website if you want a person to focus on one thing at a time.

But that doesn’t mean they always notice… People are prone to something called "change blindness". Depending on what we focus on, we can be completely oblivious to changes around us. Interesting how we only really notice what we are focused on at the time. Taking this into consideration for web design, don’t assume that because you’ve made a small change to a webpage (for instance after a click to a new page) that people will notice. Make things obviously different and bold so the user will easily recognize the difference.

7. People Crave Information. You can’t deny we live in an age where the average person obsessively checks their email and Facebook all day long. Endless Google queries. Combing through the surplus of tweets on Twitter. Random Wikipedia search sessions. Be it in front of their desktop, or staring intently into their mobile if they are on the go, we all exhibit these behaviors. We’ve come to think of it as normal. And in a sense… it is. The web taps into this natural inclination of ours: the desire to constantly seek out new information.

But what is the reason for this? Why are we so driven to learn new things? It’s simple, kids. It is called dopamine. Dopamine is a chemical released in the brain that makes us seek out things, such as love, food, sex, or even information. The simple act of aspiring to do something and the anticipation of doing it unleashes dopamine in our minds and creates a pleasurable mental state.
From an evolutionary perspective, we can see that the more you are actively seeking out these things, the more likely you are to survive. Without an appetite for food, you won’t eat. Without a desire for the other sex, you won’t procreate. Without fervor for new information, you won’t learn things (things that could potentially better or save your life). That’s why learning is dopaminergic (meaning it causes dopamine to be made). Seeking out new information helps us survive.

Interestingly, people will often crave more information than they could realistically process at any given time because it makes them feel they have more options and thus more control over their lives, which all goes back to survival. Ever searched for an answer on Google, found it, but you continue to look for more answers to validate your question? This is another reason that most people are in some sense addicted to the web; it offers absolutely endless information on any subject you can imagine, if you know where to find it. Some of the most popular websites on the internet are ones extremely rich in content: namely Facebook, Google and Twitter.

So what does this mean in regards to web design? Because dopamine is released during the stages of SEARCHING for information, NOT during receiving information, it isn’t quite so simple as to say that if you give your user all the information they could possibly want and more, they’ll be pleased. It’s the activity of allowing the user to find information, revealing that information or surprising them with information that gives them enjoyment. In fact too much information on a screen can distract from other key information, thus frustrating the user. For this reason we need to make the information clear, clean and easy to navigate.

Choice = Power. The user will still want to feel that they have many choices or access to information. For this reason, the essential information needed to help them complete their task should be at their fingertips, as well as the ability to seek out more, with more details views, click-throughs, or tooltips with extra information.

"Ask and ye shall receive." How can we give our users satisfaction in the journey of seeking out new information without making it unobvious or tedious? One way we can do this is by providing information to the user when the user asks for it. This also gives them a sense of control, which will heighten their experience. This could be in the form of expandable items, rollovers, contextual hovers, or click-throughs.

Feedback. Because humans like to be aware and knowledgeable, it is equally important to keep them informed of what is going on. Give them feedback as to what is happening behind the scenes. And importantly to do so in a human language. The computer doesn’t need to inform the user that it is requesting file 1458xj via the server. The computer needs to tell the user that their file will be there and when. Progress bars, status updates, live help are just a few ways to do this.

8. Most Mental Processing is Unconscious. Most mental processing occurs unconsciously The brain often acts without our conscious knowledge. The reason for this is that we have three brains. The old brain, the mid brain (emotional), and the new brain.

The old brain makes most of our decisions …based on food, sex and danger. These things grab our attention because they determine our possibilities for survival. The old brain was the first to be developed in the evolutionary history of animals and humans. It is the part of the brain that constantly, unconsciously, assesses your environment, deciding what is safe and what isn’t. It controls automatic unconscious processes like breathing and digestion.

As the old brains is concerned with survival above all, nothing is more important that ‘YOU’ to your old brain.

As soon as something relates to you, or the word ‘you’ is used, your old brain switches its focus to that thing. Susan Weinschenk gives this example in her book ‘Neuro Web Design’ where she demonstrates the power of using the word ‘you’ to sway people towards a product.
"First product description: "This software has many built-in features that allow for photos to be uploaded, organized and stored. Photos can be searched for with only a few steps."

Now read this paragraph for the same product: "You can upload your photos quickly, organize them any way you want to and then store them so that they are easy to share with your friends. You can find any photo with only a few steps." Which product would you buy? You’d likely buy the one that says "you" and "your". This is not a conscious decision. Your non-conscious brain will tell you that the second product is better for you.

In addition, the old brain is always looking for potential threats, food or opportunities for sex and therefore is very skilled at noticing change. As mentioned above, it is constantly scanning its environment observing changes. And there are a LOT of changes in your environment. The estimate is 11 million piece of information every second. Of that, only 40 are conscious. The unconscious mind lets us process all incoming data and evaluate what is good or bad.

"The mind operates most efficiently by relegating a good deal of high-level, sophisticated thinking to the unconscious, just as a modern jet liner is able to fly on automatic pilot with little or no input from the human, ‘conscious’ pilot. The adaptive unconscious does an excellent job of sizing up the world, warning people of danger, setting goals, and initiating action in a sophisticated and efficient manner." - Timothy D. Wilson

It is a hugely efficient tool that shows us what to pay attention to consciously while skimming through the rest. As you might remember from my previous section, multitasking is impossible - we can only focus on one thing at a time - so we need to make sure it’s worth our conscious attention. That’s why it’s such a successful system.

"The only way that human beings could ever have survived as a species for as long as we have is that we’ve developed another kind of decision-making apparatus that’s capable of making very quick judgments based on very little information." - Malcolm Gladwell

**The emotional brain is impulsive.** The emotional brain is (obviously) where all emotions are processed, and it is the root of impulses. Because of this it makes a big impact on our decision-making. The old brain and the emotional brain are very connected in the sense that if the old brain is highly aroused (by fear, or desire) the emotional brain deeply processes this information and etches it in our memory.

Because we are natural visual processors, we respond to pictures and imagery the most. Changes in visuals are easily picked up. Similarly when we think of stories or read, we break the ideas into images in our minds. These images arouse emotions in us. Imagine a news story of a plane crash with a front-page cover of burning, twisted metal shrapnel. That’s going to affect your emotional brain quite a bit. Similarly photos of a sexual nature, food or potentially dangerous scenarios will grab our attention with the old brain and sway our emotions with the midbrain.

**Our behavior is affected by things we aren’t consciously aware of.** "Unconscious processing can give rise to feelings, thoughts, perceptions, skills, habits, automatic reactions, complexes, hidden phobias and concealed desires." - Wikipedia

One way that scientists have observed this is in the instance of ‘framing’. In ‘framing’, your old brain and new brain receive these unconscious messages and you act upon them. In one study, they saw that using the words "retired", "Florida" and "tired" actually made people walk slower. Amazingly, a great portion of people’s behavior is driven by factors that they aren’t even aware of.

Both brains act without our knowledge. Rational reasoning is normally not the deciding factor.
Both the old brain and the emotional brain act without our conscious knowledge. People will always assume they made a rational and conscious decision, but in reality our decisions always start from our old- and mid-brains, and sometimes finish there too. Some decisions may come from your new brain (rational), but most are based on the subliminal messages our other brains give us based on things we react to in our environment.

**How does this affect web design?** When a website addresses all three brains, then we click and engage with the site.

If a site is visually arousing, we’ll pay attention. If it seems to address ‘our’ needs and relates to ‘you’, we’ll pay attention. If there are a lot of changes, such as movement, carousels, videos, banner ads… it will grab our attention (even if we don’t like it).

By tending to our old and mid-brain triggers (food, sex, danger, movement, change, visuals/imagery, and focus on ‘you’) with appropriate web design decisions, users won’t stand a chance at resisting clicking around a bit.

**9. People Create Mental Models.** We are going to be talking about mental models. You might have a thought about what a mental model is already, but let me show you what it actually is. Oh wait, I just did. A mental model is simply a representation in the mind of a real or imaginary thing. It is the way you imagine something to be.

For example, when I say CAKE… this is what I think of in my mind:

![Cake Image]

Maybe not quite so tall, but this sort of airy, fresh, feminine vibe. But you might envision a cake looking different. That’s because our mental models are different. If I were to bake you a cake, I might make one similar to my mental model because it would please me and satisfy my idea of how that thing should be. However you might be slightly disappointed if I gave you the pink fluffy yellow cake when your mental model of a cake was a rich dark chocolate cake smothered in ganache. As the cake baker (sub: designer), I would not satisfy you, the eater (sub: user) because I wasn’t aware of your mental model before I baked the cake (sub: designed it). You dig?

The term "mental model" has existed for around 25 years or so and first came about from K. J. W. Craik, a philosopher and psychologist, in his book The Nature of Explanation, where he proposed that the mind forms models of reality and uses them to predict similar future events. Since then the subject of mental models has been explored extensively by psychologists, and this definition, featured in a cognitive science article, sums mental models up nicely:

"A mental model represents a person’s thought process for how something works. Mental models are based on incomplete facts, past experiences, and even intuitive perceptions. They help shape actions and behavior, influence what people pay attention to in complicated situations, and define how people approach and solve problems." - Susan Carey, Cognitive Science and Science Education, 1986.
How are mental models formed? It would be impossible for any person to know and imagine the entire world in their head. There are far too many things and too many variations on things for a person to be able to do that. So the human mind makes representations (images) of the world around them that they store in their mind. These numbered concepts exist in their mind and they can create relationships between the concepts to make sense of them and to represent the world around them. Some of the places from which mental models form are:

- Prior experience with similar sites or products
- Direct experience with the product
- Assumptions users have
- Intuitive perceptions
- Things users have heard from other people

And let’s take into consideration that mental models are subject to change once the user has more experience or other assumptions arise about the thing.

How do mental models affect design? First let’s look at a different type of model, conceptual models, to better understand. A conceptual model is the actual model given to a user interface of the product by the designer. It is the concrete screens, buttons and interactions of the interface that the people who created it intended it to have. So a conceptual model is the actual look and behavior of the thing, and a mental model is the idea the user has of that thing prior to or during interaction.

When a user’s mental model and the conceptual model don’t match up, you get a "bad" user experience. Bad in the sense that the user won’t know how to use the thing, it will be hard to learn or they may not accept the thing altogether.

If they don't match, the system will be confusing to the user

Let’s look at the example of an elderly person is used to reading paper books because that was commonplace for the majority of their lifetime. Hand them a Kindle, tell them it’s a book, and the experience may be too jarring as it is completely different from their established mental model.

In addition, a mismatched mental model may lead to user errors or require too much of the user for them to figure out how to use it.

"Many systems place too many demands on the humans that use them. Users are often required to adjust the way they work to accommodate the computer. Sometimes the result is a minor frustration or inconvenience, such as changes not being saved to a file. Inaccurate mental models of more complex systems, such as an airplane or nuclear reactor, can lead to disastrous accidents." Reason, 1990

Mismatched models are a common occurrence because they can arise from so many reasons. For example:

- If the designers thought they knew who the users would be (and their level of expertise), based the design on these assumptions, and then later found out the assumptions were wrong.
- If there are several user types for the interface and the designers only designed for one mental model. The other users’ mental models would not match the design.
- Or maybe the designers don’t design for ANY mental models of the users. The conceptual model thus represents the designer’s mental model.
- Similarly, if the system isn’t designed at all and is just a reflection of the underlying technology/hardware, the mental model matches that of developers (who use or made the technology/hardware)
But how do we match our conceptual models (designs) with the users’ mental models? “Typically, the burden is on the user to learn how a software application works. The burden should be increasingly on the system designers to analyze and capture the user’s expectations and build that into the system design.” Donald Norman, 1988

We can understand the users’ mental models and design for that. In order to understand the users’ mental models we have to do research. We can do this through interviews, observation, or competitor analysis (pre-existing mental models the user might have). It’s really quite simple; just talk to the user and understand where they are coming from, what their perspective is and how they expect to interact with the thing you are designing. Then incorporate these insights into the design, rather than designing from the designer’s or developer’s mental models of how the thing should be.

One good example is if you buy a new DVD Player. The player comes with a 50-page manual on how to connect the hardware, how to install it and how to get started. In order to fully use all the features on your new player, you will have to read the entire manual to understand how to use it. But if the company that designed the player would’ve put the focus on the user and their mental model of how a DVD player should work, they would’ve re-designed and re-engineered the product so that the user could instantly hook it up and play a DVD without any hassle of installing and setting up functions. Then the instruction manual could be reduced to a one page illustration, rather than a 50-page bible of instructions.

OR we can teach the users a new mental model and prepare them for the conceptual model. If you are creating an entirely new product or you are creating a product that revolutionizes the way we think about an old product (like the Kindle did for the book), then it is okay to create a new conceptual model that changes people’s mental models. But as we saw before, people’s mental models affect the way they do or don’t accept new conceptual models. Because of this, you need to prepare the user for the new conceptual model and in the process change their mental model before they have direct experience with the product.

You can do this through training and exposure, such as creating videos featuring the new product, advertisements, examples of usage or how-to’s, and by generally putting your name and product out there in the public eye so that people can get used to it. Think: Steve Jobs unveiling every new Apple product before it reaches the public’s hands. It worked!

One great example of an introduction video to a new conceptual model is ‘Mint’ who show you how their product works and how easy it is to use, while slowly convincing you to change your mental model about how a person should bank online. Yet if you notice, they also maintain certain mental models to help you get comfortable with the idea of Mint, like the visuals of spreadsheets, charts and graphs in the beginning of the video which lead you towards the new interface. By refreshing your memory on what your mental models of banking are, they show you they get it and then introduce you to their new conceptual model. The new interface is dotted with icons of typical financial symbols as well as more graphs and pie charts to monitor your money which not only hint, but shout of ideas of banking.

It’s also helpful if you can compare the new conceptual model to an older one, or use metaphors, so that people can more quickly become comfortable with the idea of it. For instance, “Typing on a keyboard is just like typing on a typewriter, only you can undo your mistakes!”

When it comes to web design, as the web is a fairly new concept in regards to the length of human history, it’s very important to link virtual concepts with real world examples through the use of metaphors. We can do this by using icons, buttons and visual affordances, like drop shadows to suggest depth of field, light or weight, similar to objects in real life. A really great article on metaphors on the web can be found here.
10. People Understand Visual Systems. One of the most famous theories on how humans visually perceive of things is the Gestalt principle. The Gestalt principle was first introduced as a psychology concept in Germany in the late 1800's. The term "gestalt" literally means "form", and this represents the idea that the brain first sees the overall form of something and then begins to pick out the details. Let’s look at an example:

It’s Albert Einstein… or some guys with a lance.

At first you might see an old man with white crazy hair. But if you look closer at the details you’ll pick out the horse, the lances, the two men in their armour and the windmill (that looks aflame).

Here’s another example:

The face of death!

First we see the skull, but then we notice the couple drinking (a lot) of alcohol and….warming their hands over it?… Hey, I didn’t say the details needed to make SENSE.. but they are there if we look.

The point is: we notice the bigger picture first, then we hone in on the details. This idea has been expressed in the well-known phrase, "The whole is greater than the sum of the parts." Gestalt psychologists believe that there are inherent mental laws which dictate how we perceive of objects. Here are some of those laws explained:

The Laws of the Gestalt Principle: The Law of Closure. Our mind tries to close shapes and create objects even if only a bit of the shape is implied. We do this by ignoring gaps and completing contour lines. This was forms and shapes that can be imagined in the mind, even if not drawn out, from the negative space of other shapes.

One great example of ‘The Law of Closure’ is the Kanisza Triangle, seen below. This illusion was first explored in the 1950's by an Italian psychologist who showed that two overlapping triangles are seen by the human eye, even though no complete triangles exist in the image.
The IBM logo makes use of the ‘Law of Closure’ by suggesting letters with unconnected lines and gaps, but the human mind never for a second doesn’t understand that it reads ‘IBM’.

It’s just a bunch of lines

**The Law of Similarity.** Our minds group similar objects together to create collective entities. The similarity of the objects is determined by their shape, size, and colour. In this example below, the human mind connects the lime green shapes together because they have a similar colour and form, even though they aren’t on the same plane or in the same area spatially.

**The Law of Proximity.** The spatial positioning of objects causes our minds to perceive of collective entities, or in layman’s terms: things that are close together are believed to go together. In the example below, the header navigational links are all close together (and in similar colours), the sidebar items are all close to each other, and the search results are all in alignment as well. These clear groupings and the distances between the groupings helps us establish similarity and relationships.

**The Law of Symmetry.** Symmetrical objects are perceived to be collective entities, regardless of their distance apart. Really I think we can translate this to mean that any objects which are identical, or symmetrical, are understood to be related to each other. In the example below, a common remote control design shows how symmetrical buttons relate to each other and humans innately perceive of these similarities.

Opposites but equals
The Law of Continuity. The Law of Continuity focuses on how our minds see visual flow and patterns, rather than broken up shapes or angles. Our minds naturally continue these patterns, like in the example below where we see two lines crossing each other, not two angles meeting.

The Law of Common Fate. This states that objects with the same direction of movement are perceived to be a collective entity. Let’s look at this example of a graph below. All the bar shapes are of different heights, but because they move in the same direction (upward), we relate them to each other and collectively they tell us something.

Two other important principles. The following two principles aren’t from the Gestalt theory of visual perception, but they also apply to how the visual system in humans work.

Canonical Perspective. The canonical perspective states that most people imagine objects from a similar perspective and that is: from slightly above as if they were looking down at the object, and to the right or left
just a bit. Researchers who asked people to draw pictures of common objects and animals found that most people drew these objects from this subtle 3D perspective. Look at this example of coffee cup drawings:

Here you can see that most of the coffee cups were drawn nearly identical and all from the ‘canonical perspective’. But why would that be? Surely we don’t see every object from the same perspective. Take a house for instance− you normally see a house from below as it is taller than you, yet people would still draw a house from a canonical perspective or straight-on. The reason for this is that a) we imagine objects in the canonical perspective in our minds and b) this perspective gives maximum information about the visual depth of an object. Interesting. So this view helps us understand the size and depth of an object.

**Affordance.** James J. Gibson, a Gestalt psychologist, coined the term visual ‘affordance’ after he studied the affects of gradients and textures on the human retina and found out that they allow us to have better depth perception. When we can see the gradients, shadows and textures on an object, can understand its size, weight, depth and overall form.

**How does all of this affect web design?** Simply, humans first see the whole form and then notice the details and small changes. If your site has an "unpleasing" form, the design will never be taken to. This means that as designers we shouldn’t start designing the navigation, or the sidebar, or how our buttons will look− but first design the overall shape and then fill in the contents as we go. When creating webpages within a site, if you want to maintain a feeling of continuity and relationship, then the overall form of each page design should remain virtually the same, otherwise the website as a whole will feel disjointed.

The visual Gestalt principles we can take away for web design are:

- People observe the entire design/form first, and then dive into the details. Think about the flow of the overall look of the site, rather than obsessing over minute details.
- Similar colors help suggest relationships. Maintain color schemes throughout similar items and functions.
- Similar shapes help suggest relationships. Make items that do similar things look the same in form.
- Grouping of objects helps us identify relationships. Organizing items with adequate proximity and negative space around them helps us clearly see the connection of those items.
- Patterns are easily noticed by and continued in our minds. Creating similar steps in a workflow or visual affordances with interaction will allow users to notice the pattern and remember it for future interaction.
I’m sure most of those principles seem pretty obvious to the average designer, or just an average person, and that’s because these principles are so innate to our human perception of the world, that not doing these things would seem unnatural or somehow chaotic.

In regards to web design and the canonical perspective, create icons and shapes from the canonical view as people will be familiar with that representation of the thing, and they will be able to read as much information as possible about it from the angle. Do this especially if it is a new brand or product where people aren’t familiar with your logo.

In this icon above, we can tell that it is a book because of the canonical perspective. We can also see the subtle A-Z engraving and the bookmark falling down thanks to the angle, which suggests that this is either an address- or phone-book application.

Visual affordance is crucial to "good" web design because it helps people relate to the web. By bringing the 3D aspect of the real world that humans are familiar with to the 2D realm of the web, it feels more familiar and we more intuitively know how to interact with it.

Sliders are a concept we are familiar with in the real world since the 20th century. We understand holding something and dragging it. The gradients on the progress section of the bar hint at real-world lighting and suggest position of lighting (from above casting downward shadows). The deep shadow at the top of the bar suggests this is cut into the grey area and tells us about the object’s depth.

These buttons have dark shadows to suggest they are quite chunky and to really urge you to want to press them. Similarly the dial knob has a long shadow which hints at its height. The glossy metallic texture is familiar to the real world and how light hits metal. The engravings of the icons also hint at industrial processes for carving shapes in materials.
Finally the subtle texture on the background mixed with the central gradient shows us where the light is focused.

And finally in this example it brings to mind textures we are very familiar with throughout human history: paper and wood. The subtle gradient on the paper suggests it is a non-shiny, flat object. The sharp lines separating the mailboxes suggest scoring. The shadow behind the paper shows the tab is lurking there under. The stitching in the journal makes this have a very real-life feel to it (as if you needed stitching to keep together a virtual notebook). Finally, the search box looks as if it’s been shallowly etched into the wood. Overall it’s something we can relate to.

**Conclusion.** I hope you enjoyed this second part, but more so I hope you enjoyed this article as a whole (see, I went all "gestalt" on you). I hope that throughout these ten points you’ve learned some fundamental truths about how the human mind works and picked up a few ideas on how we can pay heed to this when designing for the web. I’ve certainly enjoyed writing this article, and this won’t be the last of me when it comes to writing about UX and the human mind, so check back soon my blog [http://vcareyux.wordpress.com/](http://vcareyux.wordpress.com/) for more! Thanks for reading."
