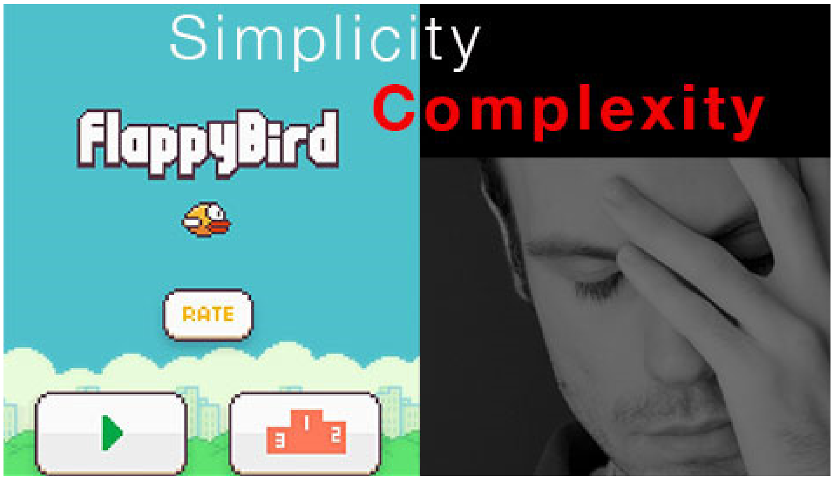
Why Flappy Bird Is / Was So Successful And Popular But So Difficult To Learn: A Cognitive Teardown Of The User Experience (UX)

Charles Mauro (http://www.mauronewmedia.com/blog/author/cmauromauronewmedia-com/), February 12, 2014

Promised simplicity, delivered deep complexity

One of the fascinating conundrums in the science of man-machine design is the human mind's complete inability to accurately assess the operational complexity of a given user interface by visual inspection. It turns out the human operating system is hardwired to judge the complexity of almost anything based on visual/spatial arrangement of elements on whatever you are looking at. This is especially true for screen-based interfaces. Simply put, the more elements presented to a user on the screen, the higher the judged initial complexity. The opposite is also true. A very simple screen leads to an assumption of simplicity. The key point here is that the actual cognitive complexity of a given UX solution cannot be judged by visual inspection… nothing is actually further from the truth. Yet we do it every time we open a new app, visit a website, or load new software.

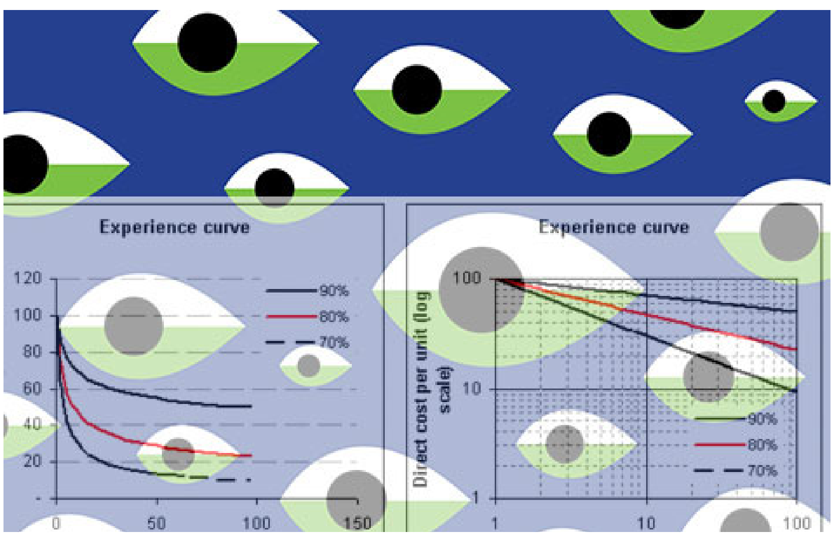


In the course of consulting in the science of human factors engineering I have constantly run into this problem. It is so ubiquitous that I have called it the simplicity/complexity deceit (SCD). The problem is everywhere we turn today: in our software, in our automobiles, in our kitchen appliances, in our media systems, and yes, even in the apps like Flappy Bird which we download for minimal cost or even free. The simplicity/complexity deceit can be reduced to a simple issue: the difference between visual complexity and cognitive complexity. Yes, it is entirely possible to create a user interface that appears upon first impression to be simple yet after slightly more use-cycles becomes hideously complex if one wishes to achieve higher levels of productivity with the system.

(F1)

But this simplicity/complexity deceit UX experience actually has a very large and persistent marketing dimension. The benefit of an initial impression of simplicity has well understood benefits that, not surprisingly, have become the mantra of contemporary UX design. Under this approach, sometimes known as minimalist UX, designers strip off every aspect of the user interface that adds graphic complexity. However, rarely, do these same designers ask the question: to what extent does this graphic simplification contribute to operational complexity. Pick up almost any app or software product today that is based on the latest operating systems and one is struck by the promise of simplicity but surprised by the actual level of complexity. Some UX solutions take this to a very high level including Twitter, Facebook, Instagram, LinkedIn, Pinterest and tens of thousands of iPhone and Android apps. Nothing in recent history takes this to a higher level than the creator of the hugely successful Flappy Bird game. In this free app-based game we have the very poster child of simplicity/complexity deceit. Here is why.

(F1)



The theory

On a basic structural level, Flappy Bird is a case study in skill acquisition theory and a very interesting one at that. Specifically, it is well known from decades of research that acquiring almost any skill including learning to use devices like the seemingly simple interactive game Flappy Bird adheres generally to the Power Law of Practice (http://en.wikipedia.org/wiki/Power_law_of_practice). In a nutshell, the law states essentially that as we practice, our ability to improve generally increases relatively rapidly but past a certain point there is almost no improvement in performance with repeated attempts. This is of course best revealed in the actual power law distribution curve that shows the well known "long tail." The interesting aspect of the power law of learning is that the actual progression toward a fully acquired skill can be very brief or exceedingly long depending on the task and related performance goals. But the general pattern remains essentially the same.

(F2)

Although most UX designers do not realize it, this simple concept is at the heart of user experience design for all the high tech devices that populate our busy lives. Furthermore, one can see by simple deduction that creating a UX solution that promises rapid skill acquisition but ends up requiring a huge amount of effort creates a measure frustration that can have a big impact on how users feel about a given product, company or brand. This maps back the concept the of Simplicity/Complexity Deceit model discussed above. It is no mystery that a designer can have a dramatic and measurable impact on the shape of the user's learning curve based on how they design the user interface between man and machine, or in the case of Flappy Bird, the interface between the game player and the game. If a UX designer is unaware of basic cognitive science including an understanding of what makes things complex to learn and use, this can be a major problem. Whether the designer/programmer of Flappy Bird knew anything about these factors is conjecture, but what we do know is that by either insight or accident they created one of the most extreme examples of simplicity/complexity deceit. This is another way of saying this simple game design creates staggering levels of cognitive complexity by tweaking a few well understood variables related again to skill acquisition theory.

(F3)

Here is a short list of factors based on my experience applying the science of human factors engineering to user interface design problems in which rapid skill acquisition is a primary objective. This is by no means comprehensive, but factors that are easy to understand in the context of the game's interaction model and reward system.

Transfer

When working with clients to help solve problems related to the usability of a given UX solution, the first question that I receive is nearly always "What is the fastest and easiest way to make the product/software/app easy to use?" The answer is always a surprise to those who ask. The fastest and least costly methodology for solving any complex interface design problem is to make the new system familiar to the users from the point of first interaction to the final task objective.

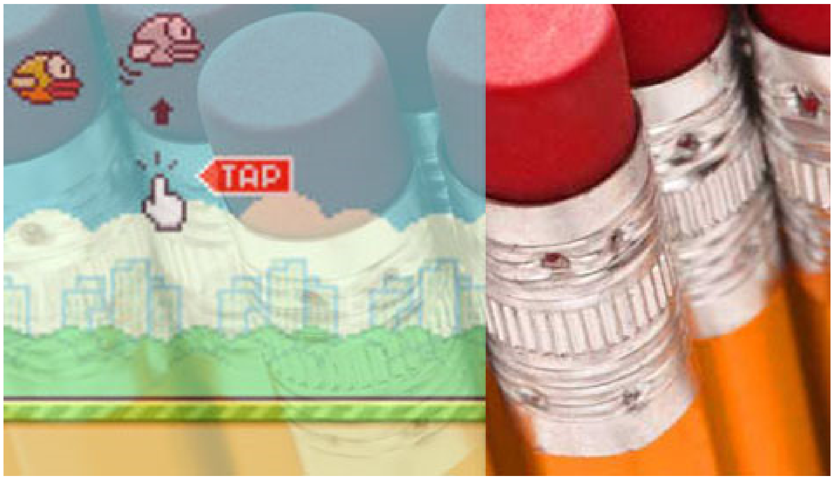
(F4)

What we mean by this in simple cognitive science terms is that there is an imperative to capitalize on the prior learning of users in the design of the new system. The single largest asset that a UX designer has in creating a highly usable interface is the prior learning of eventual users. The technical term for this is "transfer of learning." Surprisingly, this area of research is a robust area of study in the skill acquisition research space. An example of positive transfer is the layout of the controls in an automobile. When you sit in almost any automobile produced in the past 50 years, the basic UX configuration including the steering wheel, brakes, accelerator, and turn signals have highly consistent locations and operational attributes, all of which are familiar and thus result in "positive transfer." However, you will almost always end up searching high and low for UX elements that do not take advantage of positive transfer. These usually relate to the secondary control interfaces like heat/AC, ventilation, radio, Bluetooth, GPS, interior lights, USB connector and the like. What does all this have to do with a slightly tacky app game that has strained the patience of millions of users? A lot, actually.

It turns out that a UX designer has to work relatively hard to produce an interface model that has virtually no positive transfer from other user experiences with similar or even highly dissimilar games or devices. This is exactly what Mr. Nguyen has done in the creation of the basic control/display design of Flappy Bird. As far as we can determine, tapping a touch screen to control the vertical motion of a small, animated object that is driven by a relatively complex physics model has not been utilized widely (or narrowly) before… hence no transfer, much less positive transfer. One does not realize the newness of this interaction design until attempting fine motor control of the bird in a vertical location on the first few trials. Where this lack of transfer becomes painfully apparent is some 2 hours later when one has been playing the game repeatedly and not passed the 4th pipe. The shocking discovery of hidden complexity is in direct contradiction to the initial impression of simplicity presented to the user when encountering the app's initial interaction screen shown below. What could be more simple than tapping to control a flaky little bird? Lack of transfer is not the only reason that Flappy Bird is so complex. There is more, and what remains is also surprising.

(F5)

(F1) (again)



CDC

In the field of human factors engineering science there is a simple concept known as control/display compatibility (CDC). The concept sounds technical but is in fact embedded in everything we do to navigate the world around us. Like positive transfer, the presence or lack of CDC has a major impact on whether or not a given device is complex or simple to operate. CDC is simply a measure of the relationship between a device's control inputs and the resulting display of information that flows from those inputs. In operational terms, we say a device has high CDC if the physical input action results in an expected and easy to interpret output action. For example, a pencil has very high CDC because, as you grasp and push the pencil across a piece of paper, the control actions are equivalent to what you expect and see (the display actions) on the paper. On the other hand, Mr. Nguyen, creator of Flappy

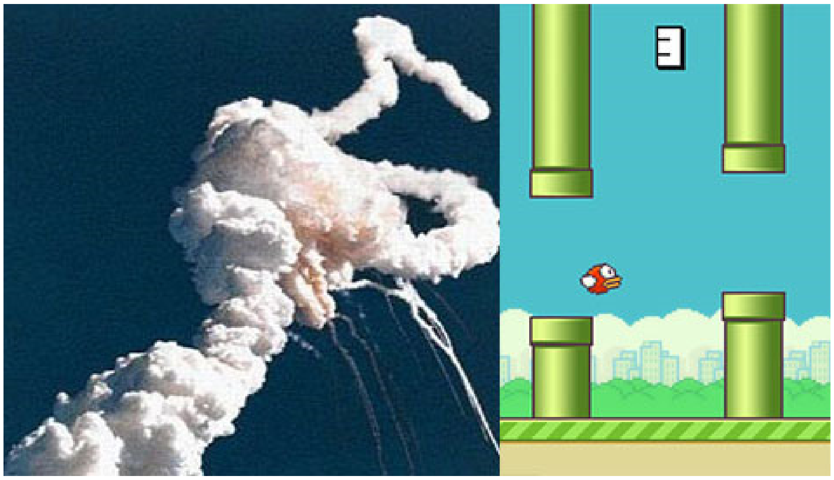
Bird, has created the equivalent of a torture chamber in terms of CDC. As an expert in man-machine systems, I marvel at the simplicity with which he has created staggering levels of complexity in a way that is exceedingly hard, if not impossible, for those who use the device to detect. Exactly what does this mean?

When we undertake common actions, we expect a familiar response on the part of the device. For the uninitiated this can be thought of as "feedback." Press the letter "a" on your iPhone and the letter "a" shows up on the screen in the next text position. These types of human-initiated actions are known as "skill repertoires." They are formed by repeated interactions with things in our world and comprise millions of interactions repeated over and over. These special types of skills become massively, almost irreversibly, hardwired into our cognitive processes and are so automatic in their execution that fooling with them can and does cause all manner of upset in our ability to interact with a device or software application. In Flappy Bird, there is not only poor CDC but outright mind-bending disruption of what we expect as we attempt to control the behavior of the object (Bird) to achieve productive levels of performance in the game. The root cause of this upset is the simple use of a tapping action to control the vertical motion of the bird.

It turns out that our skill repository for tapping results in the expected delivery of a simple instantaneous action on the device like adding a character, link or object. Tapping on a touch screen is in the same skill repository as a button push on traditional devices from decades past. It is actually slightly different because there is no button travel to reinforce the control action, but this is supplemented by audio and display action feedback on the device. iOS and Android devices possess this exact interaction model. Human factors research shows that tapping on a touch screen in place of button pushing results in somewhat lower performance due to the removal of physical key actions. But the touch screen has many offsetting benefits.

To a great extent, the complexity of achieving success with Flappy Bird is found in the use of a finger tap to control the vertical motion of an object that is driven by a physics engine with virtually no relationship to what our minds expect from a typical screen tap or button push. This form of disconnect creates a sort of traffic jam in our neural pathways as our brain is expecting the device to deliver back a response we recognize but instead the device pops a tacky, small, pixelated bird up and down, moving in a way that our mind recognizes as being associated with a tossed object as it accelerates up, slows, stops and accelerates back down. This might not seem like a big deal, but in the end, what the designer of Flappy Bird is asking your cognitive processes to do is rewire a fundamental skill repository in order to achieve success in the game. Because the human information processing (F6) system is so profoundly capable of dealing with changes in the environment, we solve this by throwing a lot of new resources at the CDC problem, attempting to control the Bird to eventual gain. A demonstration of just how upsetting this is to your skill acquisition capabilities is revealed in the amount of time it takes to even begin to move down the power law of practice curve. It takes sometimes hours of play to have any measure of control through the use of finger tapping while visually monitoring the status of the Bird programmed by way of a befuddling physics algo. Whether you realize it or not, your skill acquisition system is going into tilt from the beginning. The most surprising aspect of this design, when viewed by an expert in the field, is how the design creates high levels of cognitive complexity while maintaining user engagement.

Thinking of user engagement, it is interesting to note that this type of skill acquisition conflict is the exact opposite of the interaction model found in Angry Birds (http://www.mauronewmedia.com/blog/why-angry-birds-is-so-successful-a-cognitive-teardown-of-the-user-experience/), in which the sling shot draw-back motion and release are beautifully matched with our skill repositories for those behaviors. The CDC in Angry Birds is, for the most part, of the highest level, which objectively contributes to its success in major ways. There are other factors that make Flappy Bird hideously complex. I'll mention only one more before returning to the game.



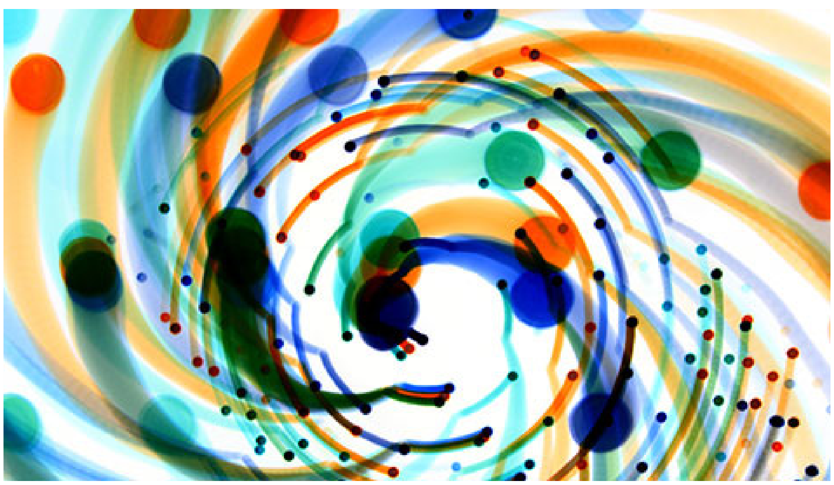
Zero errors allowed

In the field of man-machine interface design (UX design based on science) there are rules of practice which one violates at risk of professional credibility. These rules have evolved over decades of research on how to improve the fit between all manner of men and machines ranging from the B1 bomber to the iPod. At the center of such rule systems is the concept of error tolerance. Simply stated, a suitable human interface with technology should allow for both error detection and error correction. Systems that are missing appropriate levels of these attributes can be, among other things, frustrating, complex, irritating and in some cases seriously dangerous. They are also generally difficult to learn rapidly, as such systems do not allow for practiced correction of actions directly in the so-called control loop, which means they do not allow for learning to correct one's mistakes and trying it again.

(F7)

There are various reasons why error tolerance is a critical aspect of such design problems but the primary driver is the variability in the human operating system and the increasing complexity of technology. While we (humans in general) are the most profoundly flexible and clever technology, we are somewhat unpredictable and error prone. This is especially true when certain factors are present in our direct environment such as stress, certain types of distractions and emotional upsets. As a general matter, we also lack all manner of quality control in terms of how we deal with the world around us. This is the primary reason generations of engineers have tried (without success) to automate out the messy human component in technology. Historically, man-machine systems that have low or no error tolerance eventually come to a rather tragic end. There are historically significant disasters that were, at the heart of the matter, failures in error tolerance. The meltdown of the reactor at Three Mile Island or the meltdown at Chernobyl are well known case studies, as are a multitude of major airline disasters in which pilots failed to detect and correct errors in systems created without such flexibility in mind.

A fascinating aspect of the game created by Mr. Nguyen is that it affords virtually NO error tolerance. It is about as devoid of such functions as one can create. At no point in the user’s interaction with the game can they correct errors without complete loss of achievement. This is like creating an aircraft that, every time the pilot did even the smallest thing incorrectly, the plane exploded in a fireball reigning debris over Manhattan. In Flappy Bird, you are either in or you are out. This game is the most brutal example of no error tolerance. Should you get to 5000 points and miss an obstacle, you are back to ZERO…as in start over. If you correct the flight of your Bird in any way other than what is required to clear the next obstacle, your score is toast. But yet, inexplicably, millions apparently play this game for untold hours. This leads to the ultimate question…WHY do we do this, especially when the game design violates all of the central tenets of great UX design? I have a theory.



The reward system

We know, going back a few decades, that the human operating system is driven by two forms of motivation. Extrinsic motivations are those which psychologist frame as relatively superficial and related to the acquisition of things. Then there are intrinsic motivations, which are related to internal satisfactions like learning new skills, making new friends, having the respect of your peer group. In the real world, motivations are complex combinations of intrinsic and extrinsic factors. You buy a new house in a neighborhood where you make great new friends who love to play tennis, which raises your tennis game and leads to awards, which raises your position in your peer group. In this simple example one can see that motivation often interlinks factors in complex and surprising ways. Before we go too far with this line of thinking, Flappy Bird does none of this. It is simply about achievement in a peer group and a second factor I will discuss shortly. Certainly you are never going to use the tapping/Bird-flying skill acquired in achieving success again, and you are not going to share your wisdom with peers because teaching others how to achieve success on a zero error tolerant system is almost impossible. So what is the motivation here?

[(http://commons.wikimedia.org/wiki/File:LasVegas-Casino.jpg)](http://commons.wikimedia.org/wiki/File:LasVegas-Casino.jpg)

Las Vegas

Recently there has been a bevy of research studies looking into the cognitive science of gambling and more specifically how the design of various gambling casino environments impact all manner of human-mediated gambling behaviors. This is insightful stuff when thinking about why someone would spend untold hours attacking a low quality app-based game (Flappy Bird) with no apparent redeeming value. The answer I suspect is correlated with the underlying psychophysical impact of certain gambling technologies that have been around for a long time. It goes like this.

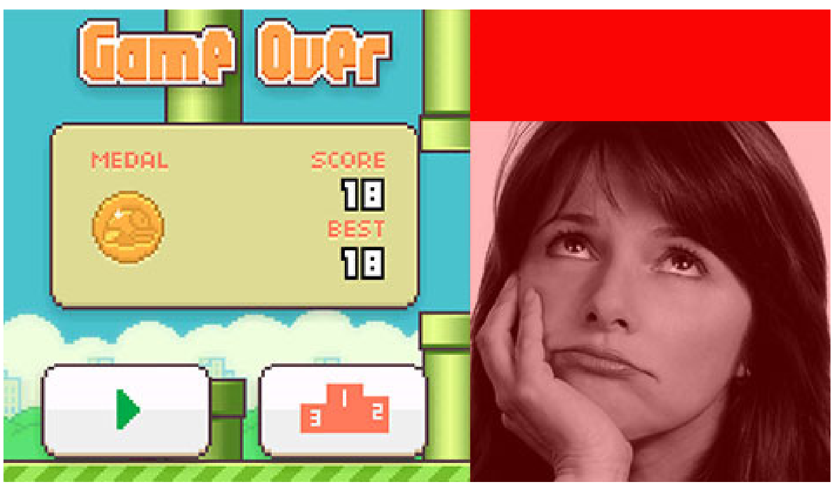
What is the single most popular gambling machine or table in most casinos? Would it surprise you to know that for the most part it is the lowest risk slot machine? More gamblers interact with and stay at these machines for hours on end than any other gaming option offered by most casinos. Why is this the case? Let's list the attributes of a typical slot machine: apparently very simple mental model with low levels of skill required to play, highly repetitive interaction model that does not appear to improve with repetitions of play and finally, virtually no error detection or error correction option possible. When playing the slots you are either in or you are out. Win or lose and return to ZERO on the next play cycle. Slots at the low end are designed to convey both simplicity of interaction and low cost of engagement (dollar slots, for example). The most important aspect of a slot machine as an interactive technology is how rapidly the machine resets for the next attempt. It is instantaneous. Lose a dollar, put in the next as fast as you can put in the next chip. It is interesting to note that a major factor in improving the profitability of slot machines was the introduction of automatic credit card charges in place of inserting coins. Less physical and cognitive effort means faster cycle times and greater winnings for the house and sometimes the gambler. Fully electronic slots removed the lever and replaced it with buttons leading to further optimization.

So enough with the slot machine; it is Flappy Bird we are interested in. It should be clear that the similarities between the interactive framework of the slot machine and those of the Flappy Bird game are striking. At the end of the day, it is likely that some of the same cognitive and motivational factors that drive slot machine use also drive engagement with Flappy Bird. The exact mix is unknowable but the overall framework is predictive. We play hours of Flappy Bird because it is fast and with each cycle there is apparently very low commitment, so we continue on working toward higher levels of achievement

F8

which in both cases can only be tagged as extrinsic rewards: one delivers chips, the other delivers bragging rights. This, however, is not the end of the story. One factor remains. (Note: these systems come at a cost.)

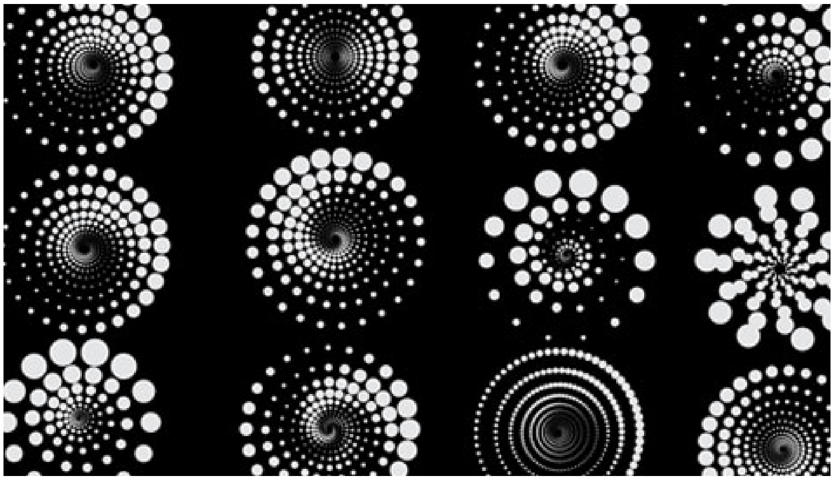
Image citation: http://commons.wikimedia.org/wiki/File:LasVegas-Casino.jpg [(http://commons.wikimedia.org/wiki/File:LasVegas-Casino.jpg)](http://commons.wikimedia.org/wiki/File:LasVegas-Casino.jpg)



The challenge of simplicity

Let’s return to the beginning. There has been significant and interesting new research over the past decade on how our cognitive systems process information on a sub-second time frame. Much of this work shows that we make judgments about a very wide range of things around us based on this first impression, which often takes place on a pre-cognitive basis. In other words, we navigate the world around us in terms of assessing the things we interact with, oftentimes without these decision reaching the level of actual conscious processing. When they do reach the level of conscious processing, our minds are often made up. We judge whether or not a website is trustworthy or well designed in sub-second processing of our first time seeing the system. These decisions are highly persistent and often do not show signs of either decay or change once they are formulated in our minds. One can see by looking back on our initial discussion about the simplicity/complexity deceit that when a given device or interface is initially judged to be simple, as in the design of the Flappy Bird first interaction sequence, it is likely that those who have experienced this impression continue to believe that the game is in fact simple and that it is their own expertise that makes it less so, even though we know from this analysis that the game is designed to be deceitfully complex if not nearly impossibly so. Mr. Nguyen used many other subtle cues including the pixelated graphic design of the game, tacky colors and the crude animations to further convince those seeing the game for the first time that it is dead simple when it is, by design, hideously complex (http://bgr.com/2014/02/11/flappy-bird-interview-difficulty/).

(F9)



What was learned?

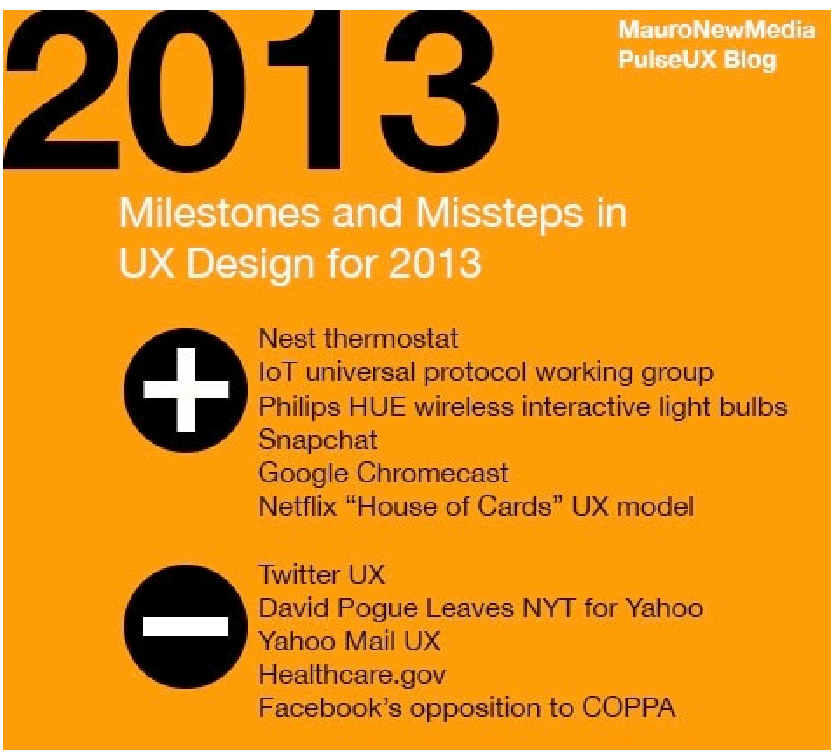
In producing a simplified cognitive teardown of Flappy Bird, we see that promise of simplicity can be surprisingly powerful and that complexity can be created in surprisingly simple ways. We see that one can design in complexity in much the same way one can design out complexity. We learned that the machine attributes that drive the use of slot machines are probably highly correlated with the motivational factors that keep us working for hours on Flappy Bird, hoping to reach a winning level. Although, just as in playing the slots, one is never really sure what winning is in real terms.

Without much of a stretch, one can see that there are significant and likely profound lessons in the success of Flappy Bird, which has recently been pulled from app stores (http://www.newsweek.com/flappy-bird-creator-says-his-game-was-too-addictive-228803), leaving many wondering why (http://recode.net/2014/02/11/the-flap-over-flappy-comic/). Some of these lessons are easily understood and others much less so, but in the end, Mr. Nguyen deserves a round of applause for promising simplicity, delivering brilliant complexity and sustaining our motivations beyond all reasonable expectations. This is no trivial game.

Acknowledgements: This post was completed with help from Emily Fisher.

Our Most Popular Recent UX Long-Form Blog Posts

If you missed any of our recent posts, here they are.



Milestones and Missteps UX/UI Design Review for 2013: Winners and Losers… Not the Usual Suspects [(http://www.mauronewmedia.com/blog/milestones-and-missteps-in-ux-design-for-2013-winners-and-losers-not-the-usual-suspects/)](http://www.mauronewmedia.com/blog/milestones-and-missteps-in-ux-design-for-2013-winners-and-losers-not-the-usual-suspects/)

[(http://www.mauronewmedia.com/blog/breaking-bad-vs-facebook-10-things-walts-meth-lab-and-zucks-facebook-have-in-common/)](http://www.mauronewmedia.com/blog/breaking-bad-vs-facebook-10-things-walts-meth-lab-and-zucks-facebook-have-in-common/)[Why Candy Crush Saga is So Successful and Popular But Will Never Be an Angry Birds: A Cognitive Tear Down of the User Experience (UX) (http://www.mauronewmedia.com/blog/why-candy-crush-saga-is-so-successful-and-popular-but-will-never-be-an-angry-birds-a-cognitive-tear-down-of-the-user-experience/)](http://www.mauronewmedia.com/blog/why-candy-crush-saga-is-so-successful-and-popular-but-will-never-be-an-angry-birds-a-cognitive-tear-down-of-the-user-experience/)

(http://www.mauronewmedia.com/blog/important-peer-reviewed-and-informally-published-recent-research-on-user-interface-design-and-user-experience-ux-design/)

User Interface Design and UX Design: 50 Important Research Papers Covering Peer-Reviewed and Informal Studies (http://www.mauronewmedia.com/blog/important-peer-reviewed-and-informally-published-recent-research-on-user-interface-design-and-user-experience-ux-design/)

User-Centered Design in the New World of Complex Design Problems (http://www.mauronewmedia.com/blog/user-centered-design-in-the-new-world-of-complex-design-problems/)

Follow us on Twitter @PulseUX (https://twitter.com/PulseUX)

Follow us on Facebook (https://www.facebook.com/MauroNewMedia)

Disclaimer: MauroNewMedia receives no compensation of any type from companies, products or individuals covered in this post. The opinions expressed in this review are those of the primary author, Charles L Mauro CHFP.

10 Comments

Steve Whetstone

February 17, 2014 at 2:22 am

(http://www.mauronewmedia.com/blog/why-flappy-bird-is-was-so-successful-and-popular-but-so-difficult-to-learn-a-cognitive-teardown-of-the-user-experience-ux/#comment-643)

Very smart analysis and an interesting read.

.

I'm curious why are you using the concept of "transfer" instead of the concept of a "mental model". is there a key distinction between the two that makes one concept better, or maybe it's just me coming from a different background and exposed to different terminology that led me to expect "mental model" discussion of that point?

.

I suggest that the sub-second visual processing (aka visual hierarchy and gestalt) have some intrinsic affect on complexity. That is to day that visual complexity contributes to some degree to cognitive complexity and vice versa. I’m assuming you know and agree, but didn’t want to complicate the article with the digression.

Reply (http://www.mauronewmedia.com/blog/why-flappy-bird-is-was-so-successful-and-popular-but-so-difficult-to-learn-a-cognitive-teardown-of-the-user-experience-ux/?replytocom=643#respond)

Charles L Mauro

February 17, 2014 at 6:17 am (http://www.mauronewmedia.com/blog/why-flappy-bird-is-was-so-successful-and-popular-but-so-difficult-to-learn-a-cognitive-teardown-of-the-user-experience-ux/#comment-644)

Steve: you are quite correct in that visual processing does of course impact cognitive processes. My intent in this simple piece was to proffer simple view of a complex problem. Mental model formation is technically another field of study compared to transfer of learning but both are related to mental model management which you correctly point out in your comment. Thanks for responding to our post.

CM

[Reply (http://www.mauronewmedia.com/blog/why-flappy-bird-is-was-so-successful-and-popular-but-so-difficult-to-learn-a-cognitive-teardown-of-the-user-experience-ux/?replytocom=644#respond)]

OwlGames24 (http://owlgames24.com/)

March 6, 2014 at 9:28 am (http://www.mauronewmedia.com/blog/why-flappy-bird-is-was-so-successful-and-popular-but-so-difficult-to-learn-a-cognitive-teardown-of-the-user-experience-ux/#comment-647)

Amazing article! Yes, Flappy Bird was very popular but have no future

Reply (http://www.mauronewmedia.com/blog/why-flappy-bird-is-was-so-successful-and-popular-but-so-difficult-to-learn-a-cognitive-teardown-of-the-user-experience-ux/?replytocom=647#respond)

Mike

June 6, 2014 at 12:52 pm (http://www.mauronewmedia.com/blog/why-flappy-bird-is-was-so-successful-and-popular-but-so-difficult-to-learn-a-cognitive-teardown-of-the-user-experience-ux/#comment-652)

I loved your blogs regarding Angry Birds, Flappy Bird and CCS. It'd be interesting to hear your take on Minecraft or on the UI of some 'successful' free open source tools such as Blender (FUE screams at you to run away) or GIMP (unengaging).

Thanks for your keen insights. 🙂

Reply (http://www.mauronewmedia.com/blog/why-flappy-bird-is-was-so-successful-and-popular-but-so-difficult-to-learn-a-cognitive-teardown-of-the-user-experience-ux/?replytocom=652#respond)

Post a Comment

Your email address will not be published. Required fields are marked *

Your Name *

Name *

Email *

Email *

Website

Website

Comment

Comment*

Submit

(http://www.mauronewmedia.com/blog/important-peer-reviewed-and-informally-published-recent-research-on-user-interface-design-and-user-experience-ux-design/)

(http://www.mauronewmedia.com/blog/apple-v-samsung-appeal-ruling-huge-win-for-design-patents/)

(http://www.mauronewmedia.com/blog/why-angry-birds-is-so-successful-a-cognitive-teardown-of-the-user-experience/)

(http://www.mauronewmedia.com/blog/what-us-airways-flight-1549s-ditching-in-the-hudson-river-teaches-companies-about-how-to-create-world-class-user-interface-design-solutions/)

(http://www.mauronewmedia.com/blog/why-the-music-industry-doesnt-have-a-prayer-against-itunes/)

(http://www.mauronewmedia.com/blog/how-new-theories-in-human-information-processing-explain-the-meltdown-on-wall-street/)

Contact: MauroNewMedia, 23 East 73rd Street, Suite 5F, New York, NY 10021 212-249-3683