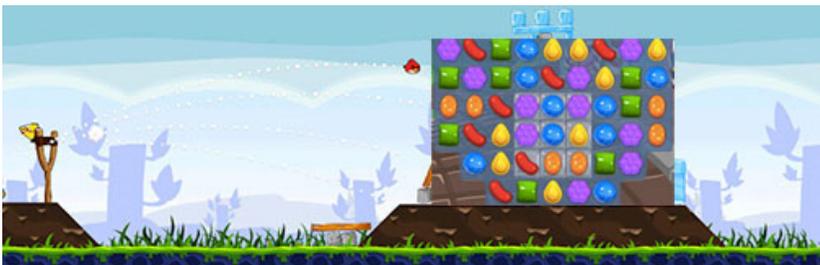


Why Candy Crush Saga is So Successful and Popular But Will Never Be an Angry Birds: A Cognitive Tear Down of the User Experience (UX)

Charles Mauro

(<http://www.mauronewmedia.com/blog/author/cmauromauronewmedia-com/>), August 6, 2013

The Big Question Why are certain computer-based games so compelling, while others fail entirely to draw us in? The answer to this persistent question, a question game designers struggle to grasp every day, is complex, but also on a certain level surprisingly straightforward. I have written and spoken on this topic at conferences and explored this question in a long-form blog post based on a cognitive tear down of the astoundingly successful game Angry Birds (<http://www.mauronewmedia.com/blog/why-angry-birds-is-so-successful-a-cognitive-teardown-of-the-user-experience/>). Over 2 million readers have viewed that analysis.



(<http://www.mauronewmedia.com/wp-content/uploads/2013/08/1-First-in-post.jpg>)

The Rush To Crush I frequently receive questions from interested parties, mostly game players, not game designers, asking why a certain new game has suddenly become wildly popular. Occasionally, one of these newbies catches my attention. Such was the case when a colleague recently inquired about the app-based game Candy Crush Saga. Here is the essence of the game: a bunch of candy-like elements (pieces) are arrayed on a simple grid. The objective is to “crush,” or more accurately, slide off the grid, as many candy pieces as possible by simply aligning alike pieces into common rows, which the game then removes from the board in a sliding action. The game then updates the score based on how many pieces slide off after a given alignment takes place. That seems simple enough, so why all the fuss?

Candy Crush Saga makes use of some aspects of advanced game design to create a surprising level of user engagement, apparently resulting in tons of downloads and millions of personal scores being widely shared on Facebook. The exact numbers seem difficult to pin down. This is all taking place in the run-up to an apparent IPO by King.com (<http://www.bloomberg.com/news/2013-06-19/-candy-crush-saga-developer-said-to-hire-banks-for-ipo.html>), developer of Candy Crush Saga. This is all interesting enough, but to be clear, Candy Crush is no Angry Birds. Here is why.

Fundamental Cognitive Process Appeal At the highest level, all highly engaging forms of new media, including game apps, must align with a specific core aspect of the human information processing system and related decision processes. When I refer to fundamental cognitive processes, I am speaking about what our Homo sapiens systems do with great efficiency and fundamental satisfaction. These are a special set of cognitive and physical processes that our evolutionary trajectory has endowed us with for both protection and enjoyment. Simply put, we do some things really, really well and others much less so.



<http://www.mauronewmedia.com/wp-content/uploads/2013/08/1-Image-1.jpg>

Getting It Right When new media provides just the right cocktail of game design attributes that engage with these special aspects of our core cognitive processes, we find such user experiences almost impossible to put down. For example, Angry Birds consumes about a billion man-hours of cognitive processes a year. This massive commitment of human information processing bandwidth reportedly costs

businesses billions of dollars in unproductive time
(<http://www.businessinsider.com/angry-birds-losses-2011-9>). What cognitive processes does Candy Crush Saga engage with that have resulted in such high levels of initial gameplay engagement?

The Great Pattern Recognizer One core attribute of the human information processing system at which we excel is our constant, insatiable, amazing drive to seek out and recognize patterns in the world around us. We look for patterns in everything ranging from the cracks in the sidewalk to the billions of phone calls gathered by the NSA. We simply cannot help ourselves. We are hardwired pattern recognizers of the highest order. But to be just a bit more specific, scientifically we are really looking for changes in patterns with which we might already be somewhat familiar.¹ Surprisingly, this is how we go about navigating the world we live in. What I mean by this is that our pattern recognition software (billions upon billions of neurons) are dynamically comparing what we recognize in our current environment and have processed pre-consciously or consciously to that same information set stored in short term or long term memory. How this happens is the subject of intense scientific research and debate.

(c1)



<http://www.mauronewmedia.com/wp-content/uploads/2013/08/2-Image.jpg>

The efficiency of this aspect of how we determine the status of the environment we navigate is astounding. By looking for different patterns present in things we already know, it is possible to deal with staggering levels of incoming data from many sensory input modalities including auditory, visual, kinesthetic and proprioceptive channels. So, what does this have to do with a tacky (okay, sticky) app-based computer game? Well, a lot, actually.

Candy and Cognitive Processes Among all of the types of patterns we seek, one we excel at is visual pattern recognition. We seek patterns in literally everything we look at and process visually/cognitively. These recognition events range from a cloud looking like a castle to the identification of the grid of LV logos on a vintage Louis Vuitton handbag or even the same exact pattern on a knockoff LV bag sold on Canal Street. In fact, our insatiable need and drive to recognize patterns accounts for the staggering amount of pattern-based adornment found in everything from the Seagram Building (<http://www.miessociety.org/legacy/projects/seagram-building/>) to the arrangement of icons on your iPhone or

(C2)

Android phone. This familiar pattern was in fact an important variable in the now famous Apple v. Samsung patent infringement case

(<http://www.mauronewmedia.com/blog/apple-v-samsung-implications-for-product-design-user-interface-ux-design-software-development-and-the-future-of-high-technology-consumer-products/>).



(<http://www.mauronewmedia.com/wp-content/uploads/2013/08/Collage-E.jpg>)

Design Patterns Not only do we seek patterns in the world around us, we include patterns in almost everything we design, ranging from wallpaper to the street grid of Manhattan. Design patterns are present on many levels. Some are less obvious than others. For example, in UX design, when properly applied, there are 3 forms of patterns present in a given interactive experience like app-based games. The first is a transparent design grid that gives structure to the layout of each interactive screen or framework.^{2,3} Second are the actual interaction patterns that are determined by the flow of the UX within and between critical tasks as the user moves through the play

experience. The final pattern is the external user-defined mental model of similar experiences that the user brings to their interaction with the design solution in front of them. This third component is known formally as “transfer” and has a long history in skill acquisition research.^{4,5} Patterns, when properly defined, help the user build a robust mental model of a complex task flow by keeping certain elements in common locations, adhering to a tight design grid, taking advantage of and building upon the user’s prior learning expectations. UX solutions that adhere to and reinforce these forms of patterns generally have dramatically improved user engagement. However, this is no guarantee.

Patterns = Expertise It has been shown through decades of research on human skill acquisition that it is our ability to recognize and recall patterns that contributes to success in the world around us. Nowhere is this fact more apparent than in the definition of expertise. In fact, we now know, based on a large body of research, that a critical aspect of becoming an “expert” at almost anything is based on one’s ability to recognize and make use of patterns that have inherent meaning.

(C3)



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Patterns in Pieces A field of endeavor where this has been studied extensively is chess. The difference between a grandmaster and a chess player of a lesser rating is essentially determined by how many chess patterns each can recognize and adjust to in a given match. However, the most important aspect of this research is that the patterns that chess experts can recognize must be real-world patterns derived from well known gameplay situations. If chess masters are shown chess boards with pieces arrayed in random order, their ability to recognize and recall such patterns is no better than beginners. Therefore, what we are really looking for in a pattern is MEANING.

Machine Made At the highest level, Candy Crush Saga is really nothing more than a very simple pattern generation machine linked to a simple, yet subtly manipulative, reward system. The basic grid of candy pieces, arrayed according to simple rules of basic orthogonal alignment, instantly challenges our pattern recognition processes by asking simply: What are the patterns of alignment present in the display that have maximum value with minimum effort? Effort, in this model, is a combination of physical

movement and mental processing resulting in the movement of an associated piece of the same shape/color found by touching and dragging the piece into a new position in the alignment grid. This results in the achievement of a higher level of pattern fit or alignment. This concept of goodness of fit is well understood and goes back to the Gestalt Theory of Perception (http://en.wikipedia.org/wiki/Gestalt_psychology), in which it was found that our visual perception system likes things to line up and conform to certain patterns. More recent science on pattern recognition supports these initial concepts.⁶



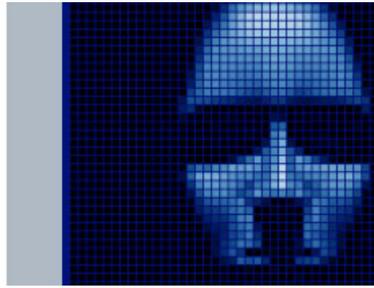
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Controls, Displays and Other Ways Assuming a new media experience like Candy Crush Saga appeals to a basic cognitive process like pattern recognition, then it is a matter of UX design to bring to life an interaction framework that is highly satisfying. One without the other is a non-starter in terms of user engagement. When game designers do this really well, we say that the system has a

high degree of control/display compatibility.⁷ Another way of thinking about this is that the man-machine combination is cognitively and functionally in synch. At the heart of game design is this simple imperative. However, in the real world of game design, this turns out to be a devilishly difficult task which few game designers or even massive game design companies can pull off with a reasonable level of predictability. The reasons for this are legion but the failure of 90% of online games is an inability to align what we do best with an interactive experience design that creates engagement with our most innate and satisfying cognitive processes. Game design is a cognitive science problem, not a computer science problem. Some may argue this point, but the marketplace speaks for itself.

) Yes! Don't forget it!

A Story Is More Than A Pattern While creating a gameplay experience that interacts essentially with our pattern recognition drive can and does produce robust levels of initial engagement, such a game will likely be of limited long term interest. Angry Birds, on the other hand, is not based primarily on pattern recognition but on an even more robust cognitive/psychological driver of the human information processing system known simply as narrative flow or storytelling (the ever-changing narrative of the feisty birds versus the stubborn pigs).



<http://www.mauronewmedia.com/wp-content/uploads/2013/08/4-Image.jpg>

Even the most clever pattern recognition game will probably not have market persistence over a compelling story. In this most basic regard, Candy Crush Saga will never be an Angry Birds. However, there are factors in Candy Crush Saga that do drive surprisingly deep user engagement. Here is a summary.

(C4)

Mental Models and Cognitive Consistency In my analysis of Angry Birds, I make the point that the design of the First User Experience (FUE) is an essential variable in the creation of engaging new media offerings like app-based games. At the core of FUE performance is the concept of schema formation or mental model development.⁸ It turns out that one can often predict with surprising accuracy the likely initial success of a game by detailed examination of the FUE based on a well understood principle in the science of cognition known generally as cognitive consistency.⁹ While a detailed discussion of cognitive consistency is beyond the objectives of this review, two underlying factors embedded in the larger context of cognitive consistency often predict the user's ability to engage initially with a new media user

experience including online games like Candy Crush Saga. By measuring or estimating the degree to which a user experience rapidly produces two levels of fluency, one can determine likely initial success and level of engagement.

Teach Me, Don't Show Me In a simplified way, all games must be first and foremost teaching systems that rapidly provide the user with two forms of fluency. The first is conceptual fluency, which affords the user an immediate understanding of the larger concept of the game. This can be thought of as the "WHAT" aspect of the game's overall conceptual structure. The second aspect of fluency that a game's FUE must provide to the user is procedural fluency. This is the "HOW" aspect of the game's UX design. These two complementary forms of fluency are only afforded to the user by the actual UX design flow of the game. At the heart of it all, game design is essentially about creating these two forms of fluency sitting on top of an appealing psychological/cognitive framework.¹⁰ One can see immediately that Angry Birds provides users with both levels of fluency brilliantly. Within about 90 seconds, one has a relatively robust grasp of both the WHAT and the HOW of the game. Alternatively, Candy Crush offers up some levels of conceptual fluency rapidly but never fully provides the user with a solid framework of procedural fluency. In Candy Crush Saga, we have the WHAT without a complete understanding of the HOW. While one can imagine the game designer of Candy Crush Saga relying on the user's desire to "discover" higher levels of procedural fluency through gameplay, such an approach

(CS)

rarely delivers better understanding on the part of users. One can be well into much higher levels of Candy Crush and still not understand how the candy pieces with special powers interact with the rest of the pieces on a given grid or how to manage more complex strategies using procedures introduced incrementally as the game levels up.



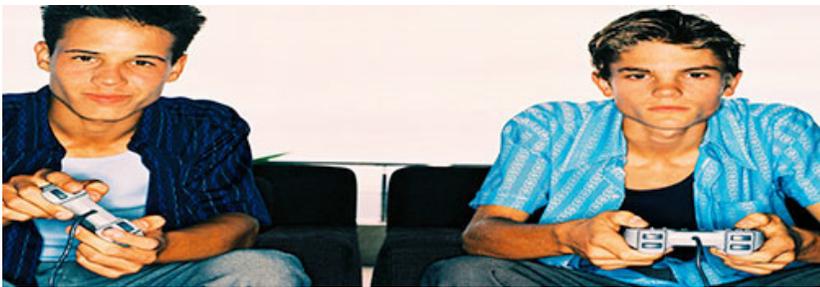
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Tools vs. Training As the user transitions from the First User Experience into actual extended play, certain aspects of game UX design can be used to dramatically improve retention of users and migration to higher levels of engagement. These types of man-machine enhancements fall generally into two categories: the provision of more tools or more training. How the game balances or makes use of these two options dramatically impacts deeper engagement with the game. In most games, UX designers opt for more tools to create deeper engagement. The reason why game designers prefer tools as opposed to training is simple enough. Tools, like new weapons, or in the case of CCS, candy pieces with special powers, are fun

to design and are often assumed to be the approach of choice for creating deeper user engagement within the gameplay experience. This, however, is rarely the case since along with new tools comes the need for new skills which are often piled on top of already weak procedural fluency. This leaves the user with tools that they do not understand and must learn before they can feel productive as game complexity increases.

Important points

C6 (a problem to avoid)



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Candy Crush utilizes this approach and one can sense the loss of engagement as more complex pieces have behaviors that one cannot manage or understand effectively. In order to deal with this obvious problem, CCS code offers up mysterious results in the form of high point totals that appear to have not been generated by user interaction with the gameplay sequence of moving pieces into recognizable patterns.

Training vs. Tools On the other hand, Angry Birds utilizes additional training that is always building on top of existing, well understood gameplay skills. This training is

C7
|

attached to the story lines and personalities of the various birds, pigs and their sometimes-wonky and elusive behaviors. Still, in the end, it is first and foremost an expansion of the HOW aspects of the UX design that drives deeper engagement with Angry Birds. Even though CCS makes use of prodigious levels of on-screen skill support in the form of cartoon figures explaining special piece functionality, the net result is not better understanding or an increase in confidence but a random walk along the pathway of new tools (candy pieces with special powers) and their befuddling and unpredictable behaviors.

C7

The Right Moves In addition, there are several aspects of the CCS UX design that work well and expand initial engagement. For example: not forcing a time constraint on users as they initially search for alignment patterns. This programming decision gives users a chance to find meaningful patterns and to possibly understand the behaviors of the special pieces without time pressure, which would dramatically increase both the stress of gameplay and the rejection rate.

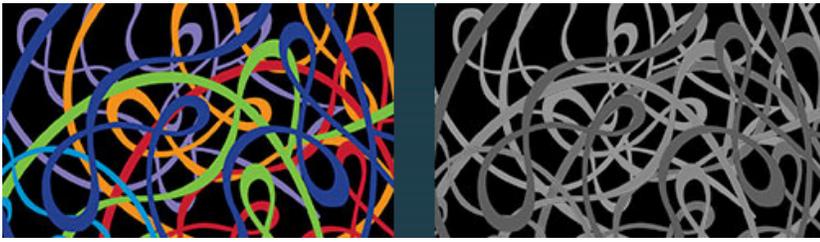


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However, this seemingly well-conceived use of time unravels without warning when the game simply ends the level attempt and reports a failure in the user's quest to achieve the required score. This uncertain injection of an unstated time constraint comes not only as a surprise but also as an insult when combined with the offer to buy additional capabilities (more on this sketchy UX monetization approach later).

Hinting and Highlighting Even though we (Homo sapiens) are highly adept and driven toward pattern recognition in visual perception, it is also a fact that human pattern recognition is an imperfect behavioral event. This issue becomes especially apparent when attempting to extract patterns from visual fields that our perceptual systems were not designed to deal with. This fact is well understood and widely studied by neuroscientists focused on visual perception research. In pattern recognition tasks that involve synthetic display of large sets of data or complex visual content, it is often helpful for the software to provide various functions that fall generally into the category of recognition enhancements. Simply put, the software looks for patterns that the user may not see and highlights such options in subtle and not-so-subtle ways through display recoloring, contrast enhancements, controlled scene animations and metadata mapping of secondary content as an overlay on the primary visual field.

C8



<http://www.mauronewmedia.com/wp-content/uploads/2013/08/7-Image.jpg>

Complex algorithms and related display methods manage these interactive enhancements. When this is done properly and the manipulation of such enhancements is left to user control, the man-machine combination can be exceedingly powerful. For example, the remote sensing and visualization systems at the core of drone technology addresses this exact problem of pattern and object recognition by combining human perceptual processing with software-based optimization of the visual field and data mapping.



<http://www.mauronewmedia.com/wp-content/uploads/2013/08/Collage-A.jpg>

Error and Related Corrections CCS also employs a well-understood method of error management whereby attempted movement of a candy piece that does not result in a viable alignment simply snaps the candy piece back

into its original position. This simple method allows the user to attempt alignments rapidly without significant cognitive effort, physical effort or fine manipulation required for error correction actions on small touchscreen devices. The CCS software takes care of managing errors in this way. While this is a viable means of managing errors, it does little to add to the procedural fluency of users. Alternatively, error management in AB provides the user with a constant means of learning, such as from errors in angle and velocity management of the sling shot mechanism propelling the birds toward their uncertain destruction of the pigs' glass houses.

Getting It Wrong There are some aspects of Candy Crush Saga that are so irritating as to be positively off-putting. At the top of the list is the audio track. Calling it music would be a stretch. One would be hard-pressed to create a more annoying and less engaging audio track for even the most banal game. It is exactly the same universal drive for pattern recognition in audio data that creates such a powerful and strong attraction to certain music. In fact, audio pattern formation is at the very heart of the entire universe of music ranging from Beethoven to the Beastie Boys. When music both lacks variation and has a highly repetitive melodic structure, it can be irritating to the point of exasperation.



<http://www.mauronewmedia.com/wp-content/uploads/2013/08/8-Image.jpg>

If one wishes to verify this point, play CCS in a crowded commuter train for more than 90 seconds and fellow travelers will have you off at the next stop. Such is the structure of the CCS game audio tracks. Fortunately, devices that run this game have sound control, however, turning off the audio feedback of the game also attenuates the strength of the game's interaction events. On the other hand, a well-executed audio track does add dramatically to user engagement if properly executed. In this regard, compared to AB, the gameplay experience of CCS gives up a very important audio feedback attribute during game play, thus impacting longer-term engagement.

Learning from AB Additionally, there are a number of other UX design features that Candy Crush Saga employs which are also found in Angry Birds. Specifically, the use of certain random introductions of surprising elements such as the fish schooling across the screen when one achieves the next level. These small touches add certain levels of both humor and mystery to the user experience. Angry

Birds employs this concept in many small and interesting ways in the design of its interactive experience and in terms of visual design.

Tacky and Campy The graphic/visual design of CCS is tacky, campy and generally too sweet for words.

Skeuomorphism is taken to a high art in the game's visual design. All of this seems totally appropriate given the concept of the game and its monetization model. It is interesting to note that another recent app-based game called Dots (<https://itunes.apple.com/us/app/dots-a-game-about-connecting/id632285588?mt=8>), with a nearly identical gameplay structure, is high-style, low-skeuo, but has a trivial following compared to CCS. This brings us finally to two important questions. First, why is the game really so successful, and second, why will it never be even remotely as successful as Angry Birds?

Dots is another game good for inspiration.

Facing the Book On the question of why Candy Crush Saga is so successful, one must not look only at the game UX design but also at the socialization mechanisms for sharing skill-level attainment with friends on Facebook. In large measure, the success of Candy Crush is likely driven more by the fluidity and simplicity of posting progress updates on Facebook than by anything like brilliant UX game design. In this regard, the game will likely have a relatively short half-life and drop into the dustbin of Facebook along with dozens of other app-based games and for that matter entire billion dollar companies like

Zynga. Even though Candy Crush Saga will surely attempt an aggressive brand extension strategy, it is unlikely that we will see stuffed Candy Crush Saga game boards anytime soon. The game simply failed to anthropomorphize or give life to its core user experience. In this regard, no other creative group outside of Disney has experienced anything like Angry Birds' staggering and globally expansive brand extension.



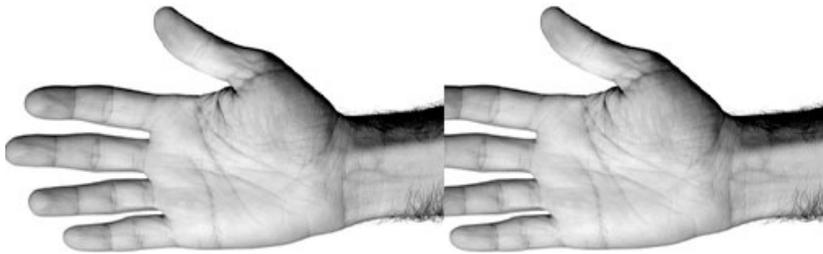
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What did Candy Crush get totally wrong compared to Angry Birds and why is that one factor likely to determine the shortfall in the success of CCS compared to AB?

Selling Expertise vs. Experience The critical learning from Candy Crush is not really aligned with game UX design but more accurately monetization strategy and how such a strategy either supports or degrades the total user experience. Underlying all successful new media UX solutions is a simple conceptual imperative: to make users feel confident and productive as they engage with a new

(C10)

interactive experience or game. Achieving this goal is no simple matter, as users seek innovation but crave familiarity. It is this combination of factors that produces world-altering UX solutions like Angry Birds. The difference between Candy Crush and Angry Birds can be summarized simply as the difference between monetizing against your user's inability to learn the system versus monetizing against the user's desire to have access to an even higher level of UX design. Candy Crush asks users to pay for their failures by buying functions that produce lower confidence and less productive outcomes.



(<http://www.mauronewmedia.com/wp-content/uploads/2013/08/9-Image.jpg>)

Give Me More To Do, Not More To Learn Angry Birds, on the other hand, does not essentially monetize against the expertise profiles of its users, but only against the delivery of a more robust user experience that makes use of all the skills and insights users already have in place. One can see immediately that the two approaches to monetization are tied up in principles of conceptual/procedural fluency and cognitive consistency.

Angry Birds monetizes against the user's desire for conceptual fluency (the WHAT), while Candy Crush Saga monetizes against procedural fluency (the HOW). Why does this matter?

Angry Birds' monetization model is simply to ask users to pay for an even better use of one's skills through upgraded game play experiences like expanded environments (for example, Angry Birds Space (<https://itunes.apple.com/us/app/angry-birds-space/id499511971?mt=8>)). Conversely, Candy Crush Saga asks its players to pay for his/her incompetence and inability to be productive.

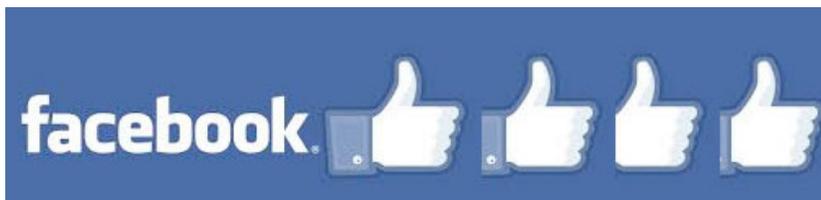
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Fundamental Differences Make the

Difference Requiring the user to pay for increased skill, versus increased use of existing skills, produces a fundamentally negative monetization scheme for the game, which, in the end, is far less effective than the Angry Birds model, in which users pay for a better game experience without the negative overhang of having to pay to increase competence. This may seem like a small matter but in the end, this factor can contribute to the success or eventual decay of games like Angry Birds or Candy Crush Saga.

(C11)

(C12)



<http://www.mauronewmedia.com/wp-content/uploads/2013/08/10-Image.jpg>

One can crush a lot of candy and realize some degree of satisfaction, but sling-shooting bird-shaped cannon balls with bad attitudes into glass houses occupied by strange-behaving pigs is far more interesting. A diet of pure sugar gets old fast.

Charles L. Mauro CHFP

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7 Comments

Charles Harrison

August 22, 2013 at 1:57 pm

(<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/#comment-532>)

Very interesting comparative analysis. What comes to mind regarding conceptual fluency and procedural fluency as well as monetization strategies is:

1. The competitive market of test prep services employing old and new media: i.e. Princeton Review, Kaplan, etc, juxtapose Knewton, Veritas, etc.
2. Similarly, there seems to be a great case for the future of Massive open online courses (MOOCs) juxtapose "brain training" services i.e. Happy-neuron, Lumosity, etc.

Reply

(<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/?replytocom=532#respond>)

Janel Torkington

October 23, 2013 at 1:49 am

(<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/#comment-533)

This is the best article that I can remember having seen regarding apps. I've wondered for ages why these games were so inexplicably addictive, and you've gone and nailed it.

I can't wait to get a spare moment to read this through once more.

Reply

(<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/?replytocom=533#respond>)

Marco

November 16, 2013 at 8:50 am

(<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/#comment-535>)

Excellent. I like these analyses a lot.

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[Furg \(http://furg.net/\)](http://furg.net/)

February 24, 2014 at 8:22 am

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Totally Agree

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