

THE SYSTEM AND SELF-REFERENCE OF THE APP ECONOMY: THE CASE OF ANGRY BIRDS

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This article presents a preliminary analysis of the app system, mainly in relation to mobile technology. By observing the app system (application system), it sets out to describe and understand its social evolution. Employing Niklas Luhmann's systems theory to examine the popular app game *Angry Birds*, this study describes the internal structure of the app system, which, in theory, acts as a social sub-system, displaying the following themes and features – first, app software and the broader social system interact and rely heavily on each other, so that, within the existing capitalist market, such interdependence clearly enables the social system-based app sub-system to establish the app platform, the app structure and, even more importantly, the simplified inner principle of apps' 'use and download' function. Second, credited to the mobile terminal, these set principles within the capital market are able to construct a system boundary and inner structure of their own. Third, the software (app) library and quantity of downloads become the common theme (shared concept) used to project the activities of the system. This (re)formulates and simplifies the complexity of the original system environment to create the self-reflexive app system. Finally, such reflexivity allows the app system to self-generate and maintain itself. Although its functions may have been well-integrated within the social system, the app system represents a closed type of self-contained/self-production mechanism.

KEYWORDS

app, autopoiesis, double contingencies, Niklas Luhmann, systems theory

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Conceptualizing the 'App'

'App' is the abbreviation for applications on computer platforms. Application services have existed for some time now and should be part of any discussion of media and information technology and industry. In 2008, Apple became the first company in the global market to launch its online App Store, and gave the app industry for mobile devices a jump start, particularly for tablet PCs, iPads and smartphones, the iPhone. Within two years of being established in 2008, the app industry led to the development of a new type of market economy, and became the 'process' of the era, with the greatest potential to change the software market since the advent of Microsoft's Windows visual operating system. According to a survey by *IHS Screen Digest* ('iPad and Kindle sales rocket', 2011), the mobile app market's output value climbed from US\$82.8 million in 2009 to US\$2.2 billion in 2010. Just like the '.com' based worldwide web, the app system has distinguished itself from the traditional internet system at both the economic and the visible market level, making it more possible for a sub-system to emerge.

As a newly emerged system, the app industry has become a major player in the market based on a few important external indicators. First, the app industry is capable of attracting capital and spreading information. Gartner estimates that by 2014, the app industry's output value will grow ten-fold compared with 2010 (in Kuang, 2011). In addition to a tremendous increase in production value, the second external feature of the app economy is 'the number of downloads'. According to ABI Research, by 2016 app downloads will reach 44 billion on mobile phones and mobile communication devices (Cheng and Lu, 2011). Although this figure already represents a significant potential economic market value, it may actually underestimate the reality. By mid 2012, apps downloaded on the Apple platform alone reached 25 billion in just 3.5 years (Guglielmo, 2012). If we include the rising number of downloads from Google's Android market, Microsoft's Windows Market Place, Samsung's Mobile Applications and Nokia's Ovi Store rise, Gartner predicts that total app downloads could reach 185 billion by 2014 (Kuang, 2011). In addition to production value and number of downloads, another feature of the app industry representative of its economic strength is its influence over or even control of consumers' behaviour. In 2010, average time per person spent browsing web pages was 64 minutes, with 43 minutes spent on applications. By 2011, the average time browsing web pages increased to 84 minutes, but time spent on apps already surpassed 80 minutes (Kuang, 2011). The app economy has built a system that has a significant restricting and guiding effect over actors' behaviour in society (Cheng, 2012).

Based on the sociological principle of 'structure/agency', the main purpose of this research is to investigate the social system embedded within the new media/app industry driven by increased internet mobility and public use of smartphones. To a large extent, this article is influenced by the central debates of relevance to

the technology determinists' discourse on the material, technology-driven society. It also reveals the transformation in media ecology, and its theoretical context will be established upon 'socio-technical theory' (Hanssen, 2011). Through interpretations based on the German sociologist Niklas Luhmann's idea of systems theory, which presents a very different approach from traditional market research or studies of ecology and political-economy, this article probes the essence of the app technology, economy and market. Some discussion on social evolution from a social-systems/functionalist perspective will be further emphasized.

The Historical Context of Angry Birds

In the early days, prior to the advent of smartphones and tablet PCs, the mobile game industry was mostly referred to as the portable game industry, which Nintendo DS and Sony PSP have dominated for more than 20 years. According to a report from American research company Flurry (see Takahashi, 2011a), as the app market first rose in 2008 Apple iOS and Google Android held 19 percent of the market, while Nintendo DS and Sony PSP were in control of 70 percent and 11 percent respectively. But in 2010, Apple iOS and Google Android increased their control to 34 percent, while in 2011 Nintendo DS and Sony PSP's share declined to just 36 percent and 6 percent. The same year ended with Apple iOS and Google Android games earning profits of US\$1.9 billion together to overtake Nintendo DS and Sony PSP's result of US\$1.4 billion in profits (Takahashi, 2011a). The changing statistics clearly demonstrate that the increase in the number of games that can be played on smartphones or tablet PCs is changing fixed public ideas of mobile gaming and putting pressure on old-school mobile game devices.

Table 1 U.S. portable game software by revenue

Year	iOS and Android	Nintendo DS	Sony PSP
2009	19	70	11
2010	34	57	9
2011	58	36	6

Source: Takahashi (2011a).

Of all apps available worldwide, *Angry Birds* stands as one of the most successful examples of a game that made the transition from the old technology on personal computers to new mobile media. *Angry Birds* is easy and simple, and one of the most popular app games. Produced by Swedish software company Rovio, *Angry Birds* was the biggest success story in terms of mobile gaming in the period 2008 to 2011. *Angry Birds'* success comes from its production value, huge number of

downloads and its tremendous effect on consumers' behaviour with regard to apps.

Looking only at Rovio's *Angry Birds* could give a misleading impression of the prosperity of the app economy. In 2006, *Angry Birds* developer Rovio faced a serious operational crisis. Despite two injections of capital, poor company structure and performance saw Rovio on the verge of bankruptcy (see Table 2). But the appearance of a new software system and mobile platforms represented a crucial turning point for Rovio. Apple introduced its App Store in 2008, and the iOS platform through its iPhone, marking a new media era of smartphones and mobile platforms. iPhone does not simply mark the birth of a new kind of phone system or computer, its structuralized touch screens in smartphones, allow simple games, accessible on a casual basis, to be developed.

Table 2 Timeline of Rovio and Angry Birds

Year	Events
2004	Niklas Hed founds Relude, targeting 3G mobile phone games Mikael Hed takes up the position of CEO. Relude starts to design games for other companies Kaj Hed invests €1 million and becomes the company's chairman. Relude is renamed Rovio.
2005	Mikael Hed resigns as CEO Rovio designa Snake for Nokia Rovio releases hardcore games Darkest Fear and War Diary: Burma
2006	First capital increase by Kaj Hed Resumes work-for-hire strategy and designs games for Electronic Arts and Nokia Capital shortage, work-for-hire market weakens
2007	Second capital increase by Kaj Hed Core team gradually dissolved
2008	With eight employees left, Rovio is on the verge of bankruptcy
2009	Mikael Hed rejoins Rovio as CEO Rovio decides to use Apple's iPhone as the development platform Develops <i>Angry Birds</i> , which tops the download chart in Finland for three months
2010	Releases different versions of <i>Angry Birds</i> <i>Angry Birds</i> reaches billion of downloads, becomes the most downloaded app worldwide
2011	Release of <i>Angry Birds Rio</i> , a collaboration with the Hollywood movie Expands in China's market Makes the <i>Angry Birds</i> movie with New Corporation

Source: Cheng (2012).

In 2009, Mikael Hed resumed his position as CEO of Rovio. *Angry Birds* was

developed in the same year and has set a few records since (Cheng, 2012). First, by mid 2011, *Angry Birds* had been downloaded 250 million times. That amounts to 1 million downloads per day. Second, *Angry Birds* players worldwide spent 200 million minutes on the game per day. Third, in the app market where products tend to have short life-cycles, *Angry Birds* was at the top of the download chart for more than two years, with paid versions downloaded more than free versions. Rovio made an initial investment of only US\$140,000 in developing *Angry Birds*, but this app has brought the company US\$70 million in profit (Kuang and Lin, 2011). Rovio experienced a big change in its external environment and was rewarded by a new market, even though there had been some difficulties in the running of its business in the past. The key turning point, which should be credited with transforming Rovio's prospects, was the unexpected growth of the Apple system.

Literature Review and Research Framework

In the context of media industry research, most research pieces employ political-economy or business models to investigate the media market. These approaches present either a critique of the media development process, or describe its internal organization, but fail to elaborate on the interaction between a specific media system and its external environment. Taking the media ecology as a whole system into account, Niklas Luhmann suggests a new approach of systems theory by which any individual media industry or organization is considered as a sub-system, and the sub-system is always shaped by the impact of the external factors of media ecology. If apps do evolve like a media and have a systematic structure, how does the app system engage in structural 'self-reference' and 'rationalization' to evolve into a modern social structure?

Luhmann's notion of systems theory is inspired and influenced by structural functionalism and integrates Parsons' (1962) idea of what he calls 'a general theory of action' to collect various core concepts across cognitive biology, cybernetics and phenomenology. Luhmann also pointed out that Parsons' social structure theory lacks two elements – self-reference and contingency (Holmstrom, 2007). According to Luhmann's thesis, the system should be the key object of analysis in capitalist society, and its most important feature is its hidden process of self-production. However, when studying how the system runs, he reminds us that four characteristics should be noted:

1. a self-production system can develop the elements of constructing itself (or its own body);
2. a self-production system normally organizes the self and the boundaries of the self, and develops its inner structure;
3. a self-production system is also self-referenced;
4. a self-production system should be seen as a 'closed system' (Luhmann, 1985).

Luhmann also believes that the continuous differentiation and operation of any social system is a direct result of the meaningful communications within the system. The self-production of the system is sustained by continuous communications and further communications. However, the communications that sustain the system must be meaningful and therefore need to reference other communications (Ball, 1978: 66; Buckley, 1967: 41). This allows communication to sustain itself through a repeated self-reference cycle. In other words, a system of self-production is one that can use the elements it is composed of to produce its own structure through continuous communications and integration. Therefore 'self-reference' has become a necessary feature of a system's operation (Luhmann, 1984: 596–7).

Reference becomes a necessary process internally in order to ensure the system's stability. It includes both internal and external reference. The reference process and the system itself form what Luhmann keeps stressing as significant – a closed system that promotes a consistent self-reference process within the system. The features of a closed system can simplify its external environment and promote internal communications within the system (Luhmann, 1993). To be more specific, such a self-referential process of communications is actually the reflective process of the person (actor) (Kao, 2002: 201–2). Through the reflective process, the system's self-reference process can be simplified. The communication process relies on and constructs a meaning system, which is presented through the chosen and reasonable symbols and symbol system. In other words, a system always chooses the most suitable symbolic codes from the symbol system to conduct self-reference.

However, we can find two core themes in Luhmann's interpretation of modern social systems. First, he regards 'self-reflexivity' as the key to understanding contemporary society's social system and operations. Second, he indicates that the idea of 'time' can also be seen as another tool to unpack the value of a system. In terms of a system's time dimension, a system refers to its past and future, which means that persons or actors within the system must refer to past experience and potential future development directions to deal with a social system that is full of double contingency (Luhmann, 1995). In short, in a society with multiple forms of information, technology, and media, complicated symbolic structures will relate to any system's time essence, making its time dimension full of expansion and compression, turning time's '*irreversibilitaet*' into '*reversibilitaet*' (Kao, 2002: 267–8).

From the perspective of the time dimension, 'time' is not only a system's basic infrastructure but also an area for social actors to make social decisions. For the app system, communication and mobile technology is the system's 'social dimension' and smartphones and apps are the system's 'material dimension'. Any app's production is affected by social and material factors, but more importantly, it is time-specific in terms of executing production, downloads and

consumption. Thus, the app system's time dimension plays a crucial role in this media technology.

Using Luhmann's interpretations of social systems, reflective process and time concept as a guide, this article now looks at the development of *Angry Birds* and the app system to identify ways in which app makers construct a closed production system, as well as how the system is transformed during the process. In terms of the broader context, a deeper look is taken at how the structure of mobile technology has been able to adapt and change according to the conditions under which it is operating. In this regard, this article identifies three separate research questions:

1. What are the features of the closed self-production app system?
2. What kind of self-reference does the app economy process?
3. What is the time dimension reference of game apps such as *Angry Birds*?

Analysis and Interpretation

Generally speaking, external influences such as existing communication technologies and users' consumption habits trigger a higher contingency in apps development. Therefore, the app economy, or app system, can be identified as what allows apps to adapt themselves in a complicated environment. In Luhmann's way of thinking, *Angry Birds* and the app system generally are media (and web) of some kind produced in order to simplify the over-complicated environment. However, the process of self-production and social differentiation also carries a risk that the system cannot balance itself. More details will be given in the following sections with regard to the system's 'closed-system' and 'reference' functions.

The Closed Self-production of the App System

Angry Birds established a unique business model in technological culture and reveals the early shape of the app system. The first feature to note is that, as seen in the example of *Angry Birds*, the app system produces internal elements to form itself. Under the complexity and contingency of the external environment, the app system uses 'app' and 'platform' to create an internal formation. Apple's iOS and Google's Android platforms are not only a transformation of traditional computer operation systems; the platforms have been adapted to become a new medium of communication. The original medium becomes a new pattern of consumption and lifestyle that guides software companies and audience behaviour. Precisely speaking, through the iOS and *Angry Birds*, 'apps' become the first basic element of the new system and help to further develop the second significant concept of 'platform'. Therefore the platforms of iOS and Android are not only a container full

of content and symbols, they are also the system's self-produced elements that link the internal structure and connect with the external world.

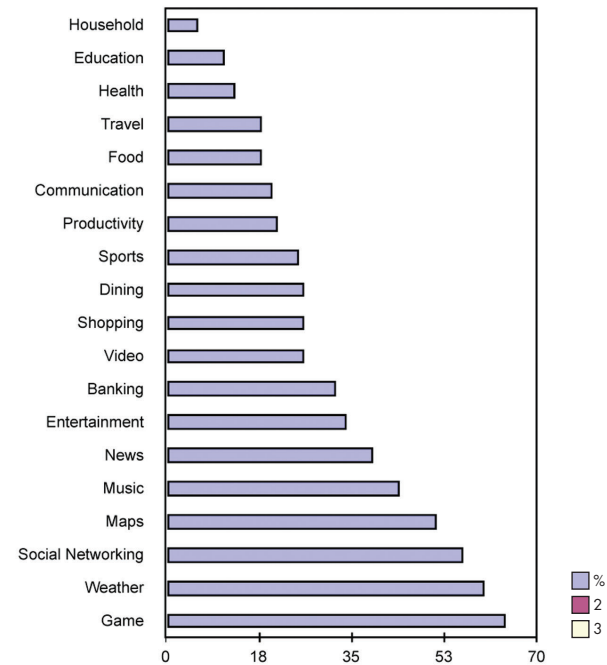
The second feature of the app system is self-boundary, meaning that it has to organize its internal order and set a boundary in order to distinguish itself from the outside world. Through the case *Angry Birds*, we can see that the app system is not given its shape by external forces. On the contrary, outside conditions such as the internet, technology and culture act as limits and uncertainty rather than structural functions that decide internal shape. Within the boundary of an app self-produced system, a triangular business model is produced through the convergence of 'app platforms', 'app software developers' and 'consumers'. From a market perspective, the three actors become a unique production value chain which determines who gets the power in the market (Dedrick et al., 2011). The app system's self-boundary changes the form of previous game ecology. No longer can a new popular game simply impact the entertainment and game industry, the point is that the mixture of a new platform and a new smart terminal device leads to a change of the internal essence of the game business operation. Thus, with easy-to-understand rules of play, a simple device, and intuitive operation, app games like *Angry Birds* liberate little children and housewives from TVs and computers. This helps those who are traditionally non-game users to adapt to the app as personal entertainment and therefore establish a solid app boundary.

The third characteristic of the app system and *Angry Birds* is that the system tends to simplify itself. As a functional autonomous system, the establishment of the app system is not the result of interaction between systems and environment, as occurs in political, economic and cultural systems. The app system simplifies its inner system value through internal communication and self-reference. The value is represented by the core action of downloading and number of downloads. When downloading becomes a self-reference of the system, it formulates a duality of internal communication – download or not download. The duality of download or not download immediately becomes the most simplified rule to manipulate and to guide the app system's social actions and experiences. That is to say, the app system in fact deals with and interacts with media behaviours, media time, media status and audience needs, but it is only through the simplified duality of download/not-download that the above social external factors can be understood and evaluated.

According to Nielsen's survey on app users in 2011 (in Kingsley-Hughes, 2011), the most popular downloaded games could be categorized as shown in Figure 1. The same data shows active users are more willing to pay for game-type apps. In terms of clear orders, the data shows that 64 percent of apps are used for entertainment purposes, 51 percent on map/navigation/search, 39 percent on news, 21 percent on production tools, and 18 percent

on food (Kingsley-Hughes, 2011). The gaming app is fundamentally separate from other app genres, and produces a greater connection with audiences. In this way, consumers and the audience become the decisive focus of software developers and platform providers, and the main resource in terms of triggering and reacting to the environment of the sub-system and its high complexity. When audiences becoming more willing to pay for downloaded apps, app games will be more likely to be able to form a self-propagating system.

Figure 1 Category of apps used in 30 days of Q2 2011



Source: Kingsley-Hughes (2011).

The Environment Reference of the App System

As mentioned earlier, the system can draw a boundary to separate itself from the environment. It can also rely on such differences to produce a process of self-

evolution. Gaming apps on all platforms have ‘smart’ features, allowing apps, as an internal part of the mobile system, to be free from conventional physical restrictions in time and space. This means users can use apps everywhere, transforming users’ spare time into merchandise without any space restrictions. Of all the app downloads, gaming apps contribute 47 percent, more than any other category (Kuang, 2011), showing that the mobility of apps within the app system gives an advantage particularly to casual gaming. *Angry Birds*, a game with a simple touch interface, is not hard to learn, has intuitive game rules and it takes only 30 to 90 seconds to finish each stage: the perfect evolution of this system (Cheng, 2012).

Second, *Angry Birds* is more aggressive than other apps when it comes to universality, as it is available on Apple’s iOS and Android, on either smartphones or tablets. It has even entered the web browser market, as it is available on Google Chrome. Rovio even formed a strategic alliance to offer *Angry Birds* on TV platforms through set-top boxes, while the company is also working with Microsoft to enter the PC market. *Angry Birds*, through expanding to different platforms and gaining access to different information interfaces, has overcome the compatibility problem common among information systems, making itself available in different forms of technologies to users anywhere. The development of devices able to work with multiple technologies determines the potential of smartphones and mobile platforms. As mobile phone communications function converges with computer technologies, the result is a smart communication system that has inherited the system features of two external systems – mobile phones and computers (Cheng, 2012). These features – efficiency, function and video/audio entertainment – help the system adapt to the language of the external environment. Smart mobile communications appear to be a convergence of traditional mobile phone and computer technologies. In fact, however, there is ‘differentiation’ and ‘division’ created in the information system, therefore the two cannot be viewed as identical.

Before Rovio developed *Angry Birds* in 2009, Kaj Head’s strategy was to design games for major companies on a work-for-hire basis, focusing on hardcore games rather than casual games. This experience allowed Rovio to learn how to run apps on a traditional computer gaming structure. Doing this allowed Rovio to create, organize and interact in a system (app system) that did not yet have a clear meaning or a stable structure. But mobile communications and traditional computers are external environments in relation to the app system, making it hard for the app industry to see the market clearly, which meant that the app system entails high risks. Rovio had previously been on the verge of bankruptcy as a result of such problems. This shows that the app industry, in order to adapt and differentiate itself from the conventional computer or information system, takes advantage of complicated computing features from these two systems and refers to the demands of efficiency and function to change the meaning and essence of electronic information communication, as space becomes more mobile

and people spend more time on leisure and entertainment activities. The app market, working under the rules and general structure of a mobile platform, recreates the system boundaries of this soft, small and casual app market. The ability to control the gigantic app economy and market no longer lies with traditional large software or information companies such as Google or Microsoft. This ability has been differentiated from the traditional software economy and evolved away from that system.

The Platform Reference of the App System

If the computer and mobile communications systems define the uniqueness of the app economy and become its external reference, then the app industry also needs to reflect on the mobile platform, the platform that has brought it tremendous success. In 2008, Apple's introduction of the App Store appeared on the surface to represent a transition from feature phones to smartphones. The result, however, has been that the advantages in hardware and production have transferred to operational platforms. This does not mean that traditional brands (e.g. Nokia, Samsung, LG, Motorola and Sony Ericsson) are losing their advantages, but the system has realized that external hardware does not meet consumers' needs for software as well as apps do. This system change in the industry and market has led to the full emergence of operational platforms. Mobile phone companies that failed to keep up with the trend all faced challenges from the market.

The tremendous potential economic value of the market not only distinguishes the app market from computers, but also traditional mobile phones. More importantly the competition on platforms also distinguishes the app market internally and has become a reference for the development of the app system. In 2010, Apple's App Store dominated the app market (see Table 3). In 2011, the app market quickly split in two: Apple's iOS and Google's Android system, with Nokia's Symbia and BlackBerry trailing behind. Mobile phones are no longer restricted to computing and communication. The platforms have become the language and set the rules upon which apps develop. The app system continues to evolve and define the structural meaning of the system.

Table 3 Revenues by operating system, 2010

Operator	Revenue (million US\$)	Growth (from 2009)
Apple App Store	1782	131.9%
BlackBerry App World	165	360.3
Nokia Ovi Store	105	719.4
Google Android Market	102	861.5
Total	2155	160.2

Source: 'Apple maintains app market lead' (2011).

Table 4 Main game products of Rovio

Year	Game	Publisher	Type
2004	Mole War	Digital Chocolate	Action
2005	Raid to Kill War Diary: Burma War Diary: Crusader War Diary: Torpedo Formula GP Racing Playman Winter Games	Rovio Rovio Rovio Rovio Fathammer Mr. Goodliving	Action Strategy Strategy Strategy Racing Sports
2006	Cyber Blood Darkest Fear 2: Grim Oak Darkest Fear 3: Nightmare Wolfmoon Need for Speed: Carbon	Rovio Rovio Rovio Rovio EA	Action Adventure, Puzzle, Horror Adventure, Puzzle, Horror Adventure Racing
2007	Burnout Dragon & Jade Patron Angel Star Marine Marine Sniper Shopping Madness Sumea Ski Jump SWAT: Elite Troops	EA Rovio Rovio Rovio Abandon Mobile Winone Digital Chocolate Vivendi	Racing Action Arcade Action Adventure Arcade Sports Action
2008	Bounce Tales Bounce Touch Bounce Boing Voyage Burger Rush Collapse Chaos Gem Drop Paper Planes	Nokia Nokia Nokia Mr. Goodliving Mr. Goodliving Mr. Goodliving Namco Bandai	Arcade Arcade Arcade Casual Puzzle Puzzle Casual
2009	Angry Birds	Rovio	Arcade
2010	Angry Birds Seasons	Rovio	Arcade
2011	Angry Birds Rio	Rovio	Arcade

Source: Cheng (2012).

The platform has become a reference of the system on two levels (Cheng, 2012). First, there has been a redistribution of competitive advantages in terms of the system's supply chain. Second, the definition of a closed/open system has changed. Within the old feature phone supply chain, mobile phone companies and service providers sell and market phones and services to consumers. However, within the app system, software developers and platform providers have entered the supply chain, turning mobile phone and telecom companies into technological channels marketing software and platform functionality. Therefore mobile phone and telecom companies are forced to communicate with app developers and platforms. However, with consumers growing more interested in smartphones, this indirectly gives platform providers and developers a greater advantage in the supply chain. The emergence of the app system has cancelled out the competitive advantages of economies of scale and distribution within the traditional mobile phone and computer markets.

The success of Rovio's *Angry Birds* highlights how app developers have changed their role from being an 'attached software producer' to becoming 'the leading platform and content provider' (Cheng, 2012). Therefore, when Rovio was designing software for Nokia (see Table 4), it was still using the old system structure. As Nokia lost its advantages in the market, Rovio decided to switch to Apple's iOS in 2009. As far as the system is concerned, Rovio did not just change partner but also adjusted itself in the new supply chain. This move helped Rovio to become a major app developer and helped the company to evaluate the platform's advantages. In other words, the evolution of a platform system and its market performance are important reference points for the app system, and should be reflected upon by companies before entering the market.

Table 5 Comparison between Apple (iOS) and Google (Android)

	iOS	Android
Feature	Closed	Open
Hardware supported	Apple product	Acer/Asus/Dell/HTC/Moto/Samsung/Lenovo
Market share of handsets (US)	27	53
Software share(by revenue)	45	43
Number of app software	430,000	300,000
Number of download	15 billion	3 billion

Source: Cheng and Lu (2011).

In addition to a rearranged supply chain, whether or not a platform is open also affects the evolution of the app system. On one hand, a closed/open platform determines the freedom a developer has to develop software. It also determines the concentration level of the system operational rules. Generally speaking, Apple's iOS is a closed system with strict control over its platform portal, only supporting Apple products. Apple has integrated together the entire manufacturing process, distribution and final sales of its products. While most other platforms are becoming more open and supporting more end devices, Apple remains a closed production chain, and the 'Apple sub-system' continues to evolve within the app system. Nevertheless Apple remains the largest app platform, with the benefit of first-mover advantage and high levels of supply chain support.

In 2011, due to closed management on manufacturing, Apple's iOS accounted for 27 percent of the global market, with 45 percent of the software revenue available in the US, 430,000 apps and 15 billion downloads (see Table 5). Android's open system and platform integration allowed it to quickly expand and account for 18 percent of market share worldwide (Cheng and Lu, 2011). In the US market, Apple's App Store for iPhone has been the most popular platform for US TV company app releases, accounting for 54 percent of all apps launched since 2009, the second most popular platform is the iPad App Store, with 22 percent of the apps released since 2009 to become available for iPad. Google's Android Market is the third most popular storefront, with 19 percent of apps released since 2009 ('TV companies embrace apps', 2011: 346). This means the app economy is stabilizing its internal operations. Software developers obtain the development principles from platform rules, and this determines the strategy in terms of marketing and launching software, such as whether an app should be paid or made freely available, or come with in-app-ads and in-app-purchase. Software developers such as Rovio show their development strength and results through the number of apps developed and number of downloads. These numbers greatly influence platform providers' competitive strategies, which will promote cooperation between sub-systems and the evolution of the app system (Cheng, 2012). In other words, any system platform would benefit from a successful casual game like *Angry Birds* to help with the systematic evolution between a platform provider and developer.

The Time dimension of the App System

Within the mobile app system, any kind of app communicated to audiences and consumers through downloads indeed occupies a certain amount of their 'real-time' behaviour. The consumption of the audiences' 'real' and 'social' time represents the combination of external factors. Their choices in terms of spending their time using this or that app form the basis of the app economic evolution. From the industrial

perspective, this further symbolizes the continuing divisions between the app production chain, app capital, app platform and app genres.

More specifically, observing the app system’s external environment, the app economy can be seen to be a contingent evolutionary process in the historical timeframe. We have to remember the App Store set up by Apple in 2008 had a huge impact on the entire economic body and order. It displaced the previous media and communication system and injected higher uncertainty into the environment and system. In order to develop itself as a sub-system within the media system, the app economy needs to simplify its own systemic complexity in accordance with the time order. As a result, the traditional targets for market capital shift. Investments are withdrawn from traditional giant game producers and instead go towards small app developers, not only creating new connections for the app system and changing the order of the external environment, but also rationalizing the app system’s self-production model. From 2008 to 2010, North American and European consumers’ general habits in relation to various types of game content, along with the rise of mobile games, have forced a fall in retail games sales from 25 percent to 20 percent. In contrast, digital and mobile distributions experienced an increase from 6 percent to 10 percent (‘Games retailers go digital’, 2011: 317). The transition in consumers’ playing habits towards app games has created a new communication style and redefined the system’s self-boundary.

The new communication mode is not simply about reworking how time is consumed or usage habits; also it means that time is restructured to allow more frequent capital flows. So many app games are eating up other entertainment forms’ shares, such as TV, movies and music. For example, the global game entertainment giant EA (Electronic Arts) merged with Playfish, and in 2011 in acquired PopCap Games, a company based on producing app games like *Bejeweled* and *Plants vs Zombies*, for US\$1.3 billion. Other examples include Facebook, with 350 million regular users, deciding to move most of its games and apps into mobile communication platforms (‘Facebook games and apps go mobile’, 2011). As apps increasingly occupy consumers’ time, and their engagement grows deeper, app games have changed the concept of time for the system.

Another issue to be considered is that, under normal procedures, consumers choose a device before picking up apps. Therefore, the development of apps can only be decided by/after ‘the first choice’. In this regard, Xyologic reported that, when comparing Apple iOS and Google Android, consumers’ app choices showed a marked difference. The 100 most downloaded apps in the App Store included 50 non-game apps, while in Android Market, more than 65 are games (Takahashi, 2011b). This number difference demonstrates the important position of ‘platform’ in the app market. Differences between platforms also decide the direction of

production and technical abilities. We can again trace the cause back to 2008 and Apple’s iOS platform and App Store. Table 6 summarizes the first 25 leading developers in both App Store and Android Market in 2011. Of note is that, apart from Burbn, all of the other developers in the Apple market are game providers. This explains how Apple gained its leading position upon first entering the market, the result mostly of the firm’s experience in developing games in the early stages.

The important function of the platform is that it decides the timeline in the app system and establishes consumers and developers’ basic understanding. It not only limits the direction of development, but also provides a structural indication for consumers. According to Nielsen’s statistics, game-type apps are the most popular, whether in iOS, Android or Windows phones. But in terms of the amount of time spent on app games, iPhone users remain the highest users, averaging 14.7 hours per month for their play. In comparison, Android users spend about 9.3 hours while the users of Windows phone, normal mobile phones and RIM BlackBerry spend 4.7, 4.5 and 4.5 hours respectively on average (Kingsley-Hughes, 2011).

Table 6 Key 25 app developers for Apple (iOS) and Google (Android)

App Store	Glu Mobile, Gameloft, Big Fish Games, Rovio, Capcom, Chilingo, Storm8/(TeamLava), Outfit7, Electronic Arts/Electronic Arts BV, Gamevil, Halfbrick Studios, DeNa(Backflip Studios/Ngmoco), Zynga/Newtoy, NaturalMotion, Pocket Gem/(Streetview Labs), Tencent, NimbleBit, PopCap, Playforge, Clickgamer, Com2uS, Burbn, Orangenose Studios
Android Market	Google, Facebook, Rovio, Adobe, DroidHen Casual, Outfit7, Magma Mobile, Glu Mobile, Go Dev Team, Kitehface Software, Skype, Notes, Nikolay Ananiev, Swiss Codemonkeys, NHN Corporation, Yahoo, Handcent, Pandora, Al Factory Limited, Kaufcom Games Apps Widgets, Verizon Wireless, Runnergames, Backflip Studios, Polarbit

Source: Takahashi (2011b).

Conclusion

This article, through observing the app market and *Angry Birds*, provides a theoretical analysis of the app system and its position in the social environment. The system reveals the following features and themes.

First, the app system closely relates to mobile communication technologies within the wider social system. It therefore promotes a profound interdependent relationship between the app system and smartphones and tablet computers. To put it simply: the increasing complexity creates more possibilities for communication technologies and generates simple rules allowing the app sub-system to establish/develop new app

platforms for use and download in the social system. These rules form a protective boundary and inner structure under the umbrella of the capitalist market.

Second, the app system, through reference to traditional computers and feature phones, has confirmed its position within the evolution of information and telecom industries. It targets pieces of consumers' time outside their working hours and then combines with entertainment under capitalism, and finally evolves as a unique app system.

Third, in addition to facing an external system as an environment, the app system's internal division of work has also started to evolve to minimize the impact of the complicated environment on the system. Whether in relation to the external market structure or types of industries, apps have established new market rules (though not yet set or mature) and therefore represent a closed production system.

Finally, working within a marketplace, game apps have had to restructure finance, mobile communications and consumer habits to frame the time dimension of the complex system. Through shifting market shares, investment moving away from previously dominant game producers, and the transformation of media channels such as mobile devices, game apps generate a connecting order of internal factors and evolve thereafter on this basis. The differentiation of the app system also shows the modern significance of differentiation within apps' social functions.

The app system provides an opportunity for the modern information or media industry to rethink the current concept of systems. Hence, *Angry Birds*, App Store and the Android Market should no longer be seen as a simple game or organized store or market. They symbolize more a simplified model of a social system with a flexible and stable infrastructure. Any single download represents the basic rule of simplifying the app system and is the result of a highly complex environment.

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