Apple and Google as an Example of an Evolutionary Red Queen Effect in the Technology World

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For an evolutionary system, continuing development is needed just in order to maintain its fitness relative to the systems it is co-evolving with.

This principle was proposed by the evolutionary biologist L. van Valen (1973), and is based on the observation to Alice by the Red Queen in Lewis Carroll's "Through the Looking Glass" that...

> *in this place it takes all the running you can do to keep in the same place*.

This theory has been applied to explain the relatively high speeds of rabbits and foxes, each of which developed faster running abilities in an attempt to gain respective advantage in the predator-prey relationship between these two animals. Our interest is in the application of this principle in the world of technology, though, not evolutionary biology. In this context, I propose that the "Red Queen Effect" is in place where there are two emerging strong competitors who, by trying to stay ahead of the other, keeps improving their products at a pace that effectively drives the remaining competitors (those below the top two) out of the market or to the brink of irrelevance.

Historically, we saw the Red Queen in operation with the race between Netscape and Microsoft's Internet Explorer as competing web browsers. As each added more powerful features, the other worked hard to catch up and then eclipse the competitor. This race pretty much drove other browsers into extinction. As Netscape waned, that project became Firefox, and it is only with the introduction of Google's Chrome browser that a new significant player has emerged. Because of Chrome's rapid pace of development and its many features (especially in the realm of HTML 5,) it might someday replace one of the two currently dominant browsers.

It should be noted that, unlike biological predator-prey relationships, each technology is both

predator AND prey. Furthermore, competition is very beneficial to the users of these technologies since it forces improvements to be made at a significantly faster rate than would be expected if one of these competitors had the market to itself.

One could argue, historically, that Apple and Microsoft have been locked in a Red Queen relationship with regard to computer operating systems, with Apple having the technological edge and Microsoft having the much larger base of users. Apple has remained a strong player in the computer domain because it has loyal users who cherish the capabilities of the Macintosh operating system. The high profit margin of Apple products insures that Apple can continue to be a dominant player, no matter what size their market is. Microsoft, however, was not complacent. Continuing developments in the OS, leading to Windows 7, insured that Apple's feature set had serious competition. The attempted encroachment of Linux into the consumer market (through releases like Ubuntu, for example) failed to reach critical mass because the two market leaders were so strong.

But if the traditional battle has been between Cupertino, California (Apple) and Redmond, Washington (Microsoft), a new and potentially larger battle has emerged between Cupertino and Mountain View, California. This battle started with the development of "smart phones," a logical blend of the personal digital assistant (such as those made by Palm) and the cell phone. While one might have imagined that Palm would have taken the lead in the development of this product, it did not. That fell to Apple (with the iOS operating system) and Google (with the Android operating system.) As in the Apple/Microsoft battle, Apple manufactured its own hardware, and Google provided the operating system to other vendors.

Aided by a fiercely loyal customer base and significant marketing, Apple quickly rocketed to the top of the market, only to see its market share decline as multiple vendors introduced Android-based products. The argument in favor of Apple is that it had a large base of developers eager to create "apps" for Apple's iPhone. These apps were available from (and only from) Apple's "App Store." Google's response was to encourage developers on their platform, allowing software to be distributed through the Google store, or from any other Android app stores (such as one created by Amazon). People could even create and post apps on the web that can be downloaded and installed onto any Android device. While iOS was (and remains) a closed system, Android is open, thus encouraging the incorporation of features that iOS has not made available to their customers – e.g., Flash. As time advances, the Red Queen competition will probably drive Apple to be more open about the kinds of applications and utilities users can have.

As for the operating system itself, Google has aggressively improved their offering for the

benefit of developers and customers alike. While millions of devices were sold using Android version 2, it was the development of Android 3 that I think had the greatest effect. With Android 2, hardware vendors were free to change the user interface pretty much any way they wanted, making consistency between hardware offerings impossible. With Android 3, while some flexibility is afforded in the layout of screens on the devices, the overall operation is the same across vendors. Finding a particular application or function is now the same on devices made by Samsung, Motorola, Toshiba, and other vendors using Android 3 or 4.

After the initial success with smart phones, Apple and Google expanded their mobile offerings to "tablets" – compact computer-like devices that perform many (but not all) tasks normally associated with personal computers. For a great many people, the ability to explore the web, handle e-mail, and run a few simple applications is sufficient. The benefit of the tablets is that they are very light and last for many hours on a single charge. Apple's offering, the iPad, rocketed to the top on introduction, but its market share is declining as Android-based tablet vendors are entering the market in silidly increasing numbers. The recent release of Android 4 is helping to build force behind Google as it tries to surge against Apple in both domains. As of this writing, over one million Android devices are purchased every day. While Apple's figures are not easy to find, my guess is that they run about half that rate, which is amazing since they are competing against several hardware vendors.

The fierce pace of competition between Apple and Google has not only resulted in rapid, significant improvements to each company's products, it has driven much of the competition to the brink of collapse. For example, the Blackberry (using the RIM operating system) has lost its dominance in the semi-smart phone world, and is thought by some to be near death. HP introduced a tablet using the Palm operating system, and sales were so low it was pulled off the market almost immediately. Nokia, whose Symbian operating system was in trouble, moved to a mobile version of Windows, but by the time Microsoft gets their mobile OS to a decent state of functionality, it will be an "also-ran" in the OS game – a position that Microsoft has not had to deal with in its history. In other words, at this time, if a new device in the mobile domain is going to succeed, it needs to use either Apple iOS, or Google's Android. Since iOS only runs on Apple hardware, this provides even greater driving force for Google's race to dominance.

As long as the Red Queen race is based on technology development, the consumer wins. But, if it moves into litigation, consumers can lose. Of course it is appropriate for people to protect their intellectual property, and lawsuits are vehicles for securing this protection. But sometimes, in the quest to secure protection, the participants in the lawsuit are fighting around technologies they didn't actually invent. Historically, this played out in Apple v.

Microsoft where the issue was the graphical user interface that Apple claimed to have invented. In an informal brief for this case, I showed that the "look and feel" of the graphical user interface claimed by Apple was, in fact, an obvious extension of the graphical user interface we had designed and implemented in the 1970's when I was at the Xerox Palo Alto Research Center. One wonders how the millions spent on this lawsuit could have been better spent to improve technology instead!

Recently, a judge ruled that Samsung's Galaxy 10.1 violates an Apple design patent by too closely resembling the iPad. The problem with this ruling (from my perspective) is that both Samsung's and Apple's designs are obvious extensions of the prop tablet computers designed by Mike Okuda for *Star Trek – The Next Generation*, a TV series that first aired in 1987. (A good example can be seen in Season 6, Episode 4, *Relics*, first airing on 10/12/1992.) Of course these were props, but the patent Apple used in its case was a design patent, not a utility patent. Design patents relate to the aesthetic design of a device, not to its functionality. This battle is far from over, but once again, millions are being spent fighting to protect something that was already known in the "prior art" (a legal term describing inventions already known to have existed) – in this case, a design that was independently crafted for a television series and shown to the public many years before the Apple patent was filed. The side-show of litigation aside, the technologies of Apple and Google will continue to advance, and consumers will be the ultimate beneficiaries of these advancements.

Overall, Red Queens are not that commonplace in the world of technology, but when they exist, the customer usually benefits from them. The current battle between Google and Apple is likely to last a long time and this, alone, should insure the rapid pace of development in numerous technologies the public will adopt and use in powerful ways.

Reference:

Van Valen L. (1973): "A New Evolutionary Law," *Evolutionary Theory* 1, p. 1-30.