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EFFECTS OF TECHNOLOGICAL CONVERGENCE AND BRAND EXTENDED STRATEGIES ON PRODUCT VALUE: CASE ON THE ADDED FUNCTIONALITIES OF ONLINE GAMES

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Abstract

Through three quasi-experimental studies with extensive data pertaining to online games, this article explores the effect of an added functionality brand strategy on evaluations of a new product. Customer evaluations improve when the advanced functionality of a new product results from the contribution of a successful, solo-branded product rather than a failed or unbranded one. Successful solo-branded and unbranded functionalities also contribute to the value of converged new products. Evaluations are more favorable when the advanced functionality reflects a cobranding strategy for a converged version of the new product; the opposite effect holds for solo branding and dedicated versions. These results contribute to research into network effects, new products, and brand strategies, as well as offering recommendations for practice.

Keywords: Brand Strategy, Online Game, Technology Convergence, Product Extension, Added Functionalities

1. Introduction

To create a converged product (CP), or a digital platform product bundle, firms integrate two or more technologies from divergent platforms into a common product on one platform, such as a mobile phone and a digital camera that combine to create a camera phone. Apple's iPhone (mobile pone + MP3) and Sony's PSP (game console + media player) are two popular CP examples (Han *et al.* 2009; Gill, 2008). With increasing bridges among telecommunications, cable television, and computer networks, more new products and services offer integrated voice, video, text, and data capabilities (Bane *et al.* 1998), such that increasing firms have opportunities to introduce CPs.

The advanced computing ability and connectivity available through mobile phones and smart televisions arise because these products integrate Internet and software applications. In

turn, software development tools enable third-party developers or interactive application developers to write applications for hardware manufacturers that produce the mobile phones and smart televisions. Thus, product categories that originate in one platform might extend to another platform, enabling Facebook to expand its functionality through phones or World of Warcraft to make its games available on both computers and mobile platforms. In practice, software developments seem more likely to shift Internet-related products toward mobile phone and television platforms, especially as social networking tools extend their functionalities to mobile and television platforms.

Noting these trends, we use the concept of a CP to explore the effect of brand strategies on consumers' evaluations of new products that feature added functionalities from a different platform. The new products we consider result from moving a functionality from one product category (e.g., platform) to another (e.g., different platform with network capabilities). Specifically, we focus on added functionalities and new products that offer network effects. In contrast with prior research, our study accounts for not just product value but also technological convergence and distinct brand strategies. Using quasi-experimental studies, we investigate whether the value of a new product increases because its added functionality involves some combination with another (successful) brand. Different CPs may reflect various particular brand strategies (e.g., solo versus cobranding), and we investigate these influences as well.

2. Literature review

Research pertaining to telecommunications, cable television, and computer networks notes the value of a product ecosystem, such that value stems from both product performance and network effects (Farrell and Saloner, 1985; Katz and Shapiro, 1985, 1986; Frels *et al.* 2003). In such settings, a product ecosystem provides the base product (i.e., platform), and its functionality entails its respective network effects. We seek to extend these prior studies by focusing on the effect of an extension strategy for a functionality (i.e., complementary products or services) on value in the product ecosystem. Thus, the research findings can contribute to a better understanding of product value, technological convergence, and brand strategies.

2.1. Product value

A product with network effects often relies on technological lock-in effects, such that a product used on one (closed) platform (base product) cannot work on others. Prior studies emphasize battles over technological standards (Arthur, 1989), such as the QWERTY versus the Dvorak keyboards, VHS versus Betamax video tape formats (David, 1985), and Sony PlayStation 3 versus Microsoft Xbox 360 video game platforms.

Products on such platforms embody an ecosystem. Because a video game typically functions on a particular game machine, the related network creates a dynamic interplay of user networks and complementary effects (e.g., availability of complementary software, products, or services; Frels *et al.* 2003; Wang and Xie, 2011). The value of the product ecosystem depends on the product's performance, as well as its network effects (Frels *et al.* 2003). Consumers prefer to buy products for which compatible options are already available; compatible products also increase switching costs (Klemperer, 1995). Accordingly, firms in these markets often use penetration pricing to compete ex ante for ex post market shares and lock in consumers to their platforms (Farrell and Klemperer, 2007; Klemperer, 1987). In contrast, products on an (open) platform allow users to interact across online servers or hard-wired terminals, requiring the support of multiple players and products from various complementary networks. In this case, consumers are locked in to the emotional experiences they gain from the network, which makes them less likely to adopt a new product (Yeh, 2012).

Network effects also influence consumers' decisions and thus market competition (Farrell and Saloner, 1985; Katz and Shapiro, 1985, 1986); they can lead to consumer inertia, lock-in, or path dependence, which might favor established, inferior products to newer, superior ones (Farrell and Klemperer, 2007; Katz and Shapiro, 1985). Yet, Tellis *et al.* (2009) argue that changes in market share leadership often follow switches in quality leadership. For a product with network effects, better quality still should dominate.

Previous research already has established that products with network effects on platforms create dynamic interplays among users, as well as complementary effects (e.g., availability of complementary software, products, or services; Frels *et al.* 2003; Wang and Xie, 2011). By extending this view to new products, we argue for a revised view of value that comprises both the base product (e.g., mobile phone, television) and the added functionality, with network effects.

2.2. Technological convergence

A CP results from a traditional bundling practice, in which the firm integrates different product categories (Stremersch and Tellis, 2002), so the ultimate product comprises both the base product (new product category or platform) and its functionalities (complementary products or services). For this study, we focus on high-tech base products, such as mobile phones, cable televisions, and computer platforms. For example, the iPhone (base product, telecommunication platform) features apps (added functionality, computer platform), whereas game consoles (base product, cable television platform) allow users to play online games (added functionality, computer platform) through a network adapter. The value of a CP depends on both the base product and the functionalities.

In practice, many firms offer converged and rival dedicated versions of their CPs simultaneously. When consumers make product choices, they might suffer perception biases, such that they do not rely solely on product performance to decide (Kahneman, and Tversky, 1979). For high-tech products for example, consumers likely consider performance (functionality and reliability) first, but they also make convenience assessments (Christensen, 2000). If added functionalities offer low levels of technological performance, consumers might select converged rather than dedicated options. However, this choice pattern seemingly should reverse if the added functionalities enhance the levels of technological performance. An advanced functionality added to a high-performance base product likely causes consumers to place more weight on the performance of the CP; if the base product achieves only low performance, consumers assign more weight to convenience.

In addition, Gill (2008) proposes that evaluations of CPs are utilitarian or hedonic, depending on an asymmetric additive effect. Thus, a hedonic functionality may enhance the pleasure of using a utilitarian base, but a utilitarian functionality likely dilutes the fun of a hedonic base. Such (functionality) extensions require moderately high but still reasonable skill transfers (Kumar, 2005b). We posit that the added (hedonic) functionality of a new product should not be just compatible with the platforms (e.g., telecommunications, cable television) but also moderately feasible and not trivial.

To test these predictions, we focus on massively multiplayer online role-playing games (MMORPG), which require real-time connectivity among players, and we consider the influences of both converged and dedicated versions of two base products: mobile phones and television consoles.

2.3. Brand strategy

A brand is the name, design, symbol, or any other feature that identifies one product as distinct from others. Consumers use brands as cues (Feldman and Lynch, 1988; Lynch *et al.* 1988); firms use brands as signals to convey intangible product or service information, which consumers then encode and retrieve to evaluate new products or offerings (Joshi and Mao, 2012; Shine *et al.* 2007). For example, with a successful brand extension (Kumar, 2005a), consumers encode and retrieve brand information cues to evaluate new products. They should anticipate that the brand extension will possess certain properties or benefits; their perceptions of the value of such extensions depends on whether they believe the quality of the parent brand has transferred to its extensions (Song *et al.* 2010).

If they use a solo-branded strategy, firms convey parent product information to influence consumers' perceptions of an added functionality. If they use a cobranded strategy, they seek to combine the attributes of two parent brands to influence perceptions of the addition. This

simultaneous introduction of two brand parents of an extension can have positive effects on product evaluations (Kumar, 2005b). The synergy that arises when the two brands are complementary occurs only when the products vary (e.g., digital camera and digital photo printer), not when they belong to the same category (two digital cameras) or to unrelated categories (a digital camera and a snowboard) (Shine *et al.* 2007). For example, consumers prefer to recombine many convenience items (e.g., playing a single game with simple connection functions) from new products (i.e., cobranded strategy).

2.4. Impact of technological convergence on brand strategy

When they introduce new products, firms must decide what kind of brand strategy to apply to highlight the added functionality. The strategy should be compatible with each product version (i.e., dedicated or converged; Stremersch and Tellis, 2002). For example, if a functionality moves from one platform to another, it represents a form of brand extension, such that it uses an established brand (product) name to enter a new category (Kumar, 2005b). If the firm chooses a cobranded extension, attributes from each parent brand combine to establish the new product (Shine *et al.* 2007; Kumar, 2005b). In that case, consumers' perceptions of the extension depend on whether they believe that the quality or attributes of the parent brand (product) transfer to the extension.

We investigate the brand strategies companies might use to introduce CPs in this study. Whether the transferred perceptions resulting from a solo-branded strategy or the synergy effects of a cobranded strategy are more effective remains an open question. That is, a particular extension is not certain to achieve more favorable consumer evaluations due to either strategy. Instead, we argue that when consumers place more weight on performance versus convenience dimensions, the effects of different brand strategies on perceived product value should vary.

3. Hypotheses

A brand provides useful cues that help consumers validate a category, by establishing an association between the brand name and the category (Kumar, 2005a; Tversky, 1977). Consumers often store their brand attitudes in memory, then retrieve them later, when they are exposed to information or some stimuli. A retrieved positive attitude should provide a favorable judgment context, increasing consumers' expectations about product performance (Shiv and Huber, 2000).

The brand also serves as an important source of inferences and information about a new product. Consumers transfer their brand beliefs and affect to new products with the same brand. Because consumers use the brand as a judgment cue, the quality of a parent brand should transfer to new products that feature the same brand (Joshi and Mao, 2012; Song *et al.* 2010).

In turn, the transferred cues for solo branding strategies should be stronger than those for an unbranded strategy. If an advanced functionality extends into another platform, the performance of the base product provides reference information. If that base product offers high performance, consumers should tend to rely on the performance dimension, which implies a stronger effect of a solo branding strategy in terms of enhancing the perceived value of the new product. However, if the base product offers weak performance, consumers might prioritize convenience, in which case the effect of a solo-branded extension on new product value seemingly would be weaker. Therefore,

H_1: Evaluations of a dedicated version of a new product are more favorable when the advanced functionality is a solo-branded product rather than an unbranded product.

A successful brand extension leverages the common attributes between the extended product and the parent (Tversky, 1977). If it fails, these common attributes get disrupted. Therefore, only successful extensions enhance customers' perceptions of the similarity between the parent and the extension (Kumar, 2005a), which support transfers of information from the parent categories. Customer evaluations of a new product therefore should be more favorable

when the newly introduced, advanced functionality is a successful solo-branded extension, whether the base product offers high or low performance. Therefore,

H_2: Evaluations of a new product are more favorable when the advanced functionality is a successful, rather than a failed, solo-branded extension.

Unlike a solo-branded extension, a cobranded extension reflects a composite brand concept, comprising characteristics of two parent brands (Cohen and Murphy, 1984). The two brands, each with individual attributes, jointly present an extension, to which they seek to transfer a subset of their attributes (Shine *et al.* 2007; Kumar, 2005b). A synergy effect occurs when the extensions are complementary (Shine *et al.* 2007). For example, a cobranded extension by brands A1 and A2 might add a functionality to brand B, whether for television (platform 1a) or mobile phone (platform 1b) base products. Alternatively, a solo-branded extension by brand A1 could extend to brand B, whether for television (platform 1c) or mobile phone (platform 1d) base products (Figure 1). For online role-playing games, for example, a new game might provide single player or simple connectivity functions on an Android/IOS (mobile) platform.

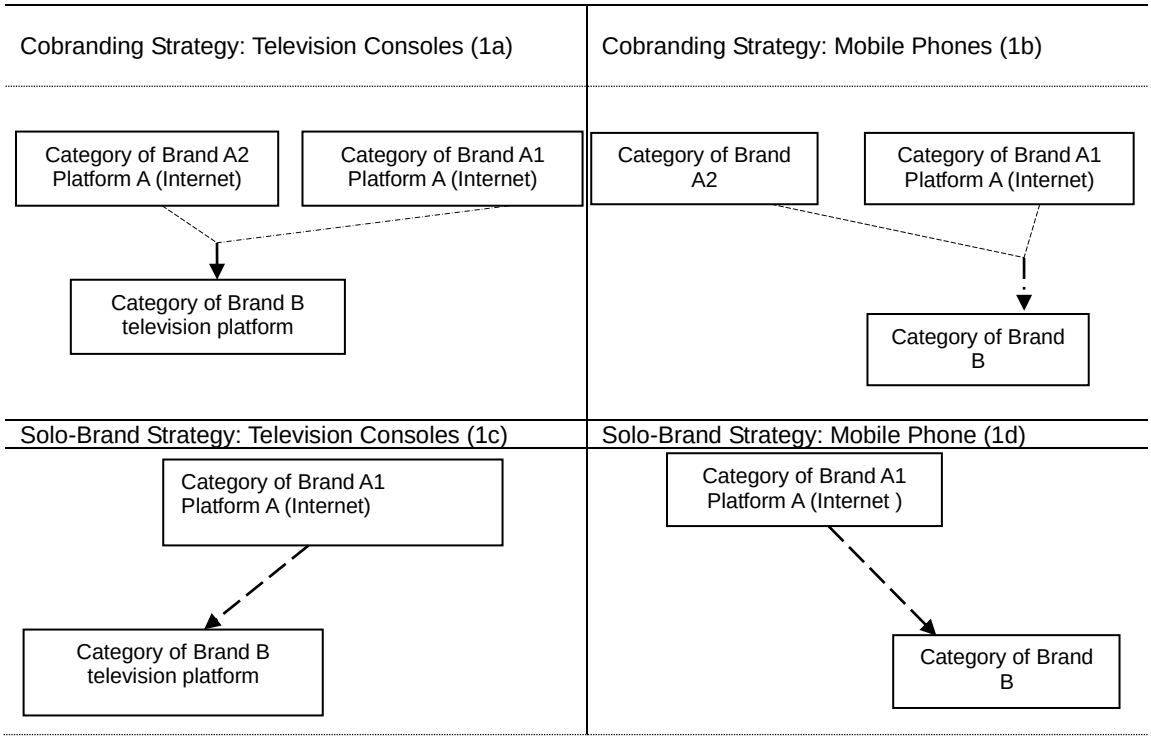

Figure 1. Different Brand Extensions on Various Platforms

When consumers assign more weight to performance or convenience dimensions (Han *et al.* 2009; Zhang *et al.* 2007), it influences their evaluation of the new product. For a cobranded extension of a low-performance base product, consumers likely prioritize the convenience dimension, and we predict that synergy effects dominate. The choice pattern should reverse for solo-branded extensions of high-performance base products. Therefore,

H_3: Evaluations of a new product are more favorable when an advanced functionality uses (a) a cobranding strategy for a converged version and (b) a solo-branding strategy for dedicated versions.

4. Pretests

Consumers engage in psychological processing to judge product value, partially on the basis of their stimulus- or memory-based inferences (Cronley *et al.* 2004). Stimulus-based inferences generally entail available information (e.g., brand strategy) that consumers can access readily. We argue that new product value comprises both the base product (e.g., mobile phone, television) and the added functionality, with network effects. If consumers adopt a new product with added functionality, it should increase product performance and user network effects. For this study, we use mobile phones or television platforms as the base product; the added functionality is an online game. To identify appropriate stimuli, we conducted three pretests.

4.1. Pretest 1

We began by searching for stimuli in a computer network setting that would be popular and strongly associated with new products and be likely to evoke participants' interest. We interviewed seven heavy users who had been playing online games for at least four years. For the cobranded extension, we needed two somewhat related product categories, which could enable us to assess perceptions of intercategory similarity and skill transferability across platforms (i.e., telecommunications or cable television). Furthermore, the functionality needed to be compatible with the chosen platforms (telecommunications and cable television), moderately feasible, and not trivial. Such extensions generally require moderately high but still reasonable skill transfers (Kumar 2005a). Therefore, MMORPGs emerged as an appropriate stimulus, with the added functionality of real-time connections.

After selecting MMORPG and real-time strategy connections, we identified one brand within each category that was well liked and strongly associated with its parent in the computer networks category. The seven players reviewed a list of brand names for available product categories. The most popular brands were *Lineage*, *Age of Empires*, and *Warcraft*. Because *Warcraft*, a real-time strategy game, offers a name similar to that of the online *World of Warcraft* game, even though they are completely different, we decided to use *Age of Empires* as the real-time strategy game, to avoid any potential confusion.

4.2. Pretest 2

Consumers reported their perceptions of the association between the attributes of a role-playing game in a computer network and a hypothetical extension to a mobile phone or a television platform, according to a solo-branded strategy (e.g., *Lineage*) (Kumar, 2005b). The extent of their agreement with the measured attributes was assessed on five-point response scales, ranging from "strongly agree" to "strongly disagree." The association (α = 0.87) for the television platform (M = 3.84; SD = 0.06) was stronger than that for mobile phones (M = 3.27, SD = 0.05; t(42) = 2.57, p = 0.01). The pretest results also indicated that the television platform for the new product provided a hedonic base, whereas the mobile phone represented a utilitarian base.

4.3. Pretest 3

Trained interviewers approached 300 randomly selected users in cybercafés. Of the 251 completed surveys, 228 were usable, for a response rate of 90.8%. Of these, 109 respondents considered the extension to the mobile phone, and 119 imagined the scenario for the television platform. We then tested the anticipated performance of *Lineage* on each platform (Yeh, 2010), using eight items:

1. The design of each style is exquisite.
2. The style design has many varieties.
3. The appearances of each style have many selections.
4. The features of each style have many plentiful types.
5. The function of each style being displayed has many varieties.
6. The apparatus of each style has many plentiful types.

7. It provides many dynamics and static activities or services (missions) within the context of this product.
8. The scenery (e.g., background screen) is abundant in the context of this product (in the fictional plot of a product).

For each attribute, the respondents indicated their agreement on five-point response scales, from “strongly agree” to “strongly disagree.” The attribute scores (α=0.93) for television consoles (M = 3.90, SE = 0.06) were significantly higher than those for mobile phones (M = 3.74, SE = 0.06; F(1,225) = 3.78, p = 0.05), which suggested using the television platform for the dedicated version and the mobile phone for the converged version.

5. Main studies
5.1. Variables and analysis
5.1.1. Stimuli and design

The information included in the study stimuli highlighted the added functionality (online games) and base product (mobile phone or television platform). The base product information came from Yeh (2010). In addition, the cobranded extensions featured subsets of attributes from each parent brand (*Lineage* and *Age of Empires*). Two pictures and the specific attribute information for *Lineage* and *Age of Empires* came from a gaming website (www.gamer.com.tw). The attributes detailed the design, appearances, features, functions, and apparatus of each style (e.g., game role), as well as dynamic and static activities or services (missions) and scenery (Yeh, 2010). The unbranded product featured the same attributes as *Lineage*, but we named it “X product.”

5.1.2. Procedure and participants

In the experimental process, explaining each stimulus would have taken about two pages. Instead, players viewed pictures or read information about the stimuli; after receiving an explanation of the attributes of the new online game and its base product, they answered the study items. The stimuli for Studies 1–3 were randomized, and we used quota sampling in 191 cyber cafes in 12 districts of Taipei—the city that features the highest density of cyber cafes in Taiwan. Consumers received NT$50 (approximately US$1.67) for their participation and were interviewed by trained interviewers, over the course of two months.

5.1.3. Independent variable

Brand value served as the independent variable, reflecting a measure of the manipulated brand strategy. The brand offered high quality, superiority, and positive views, according to the responses we gathered on three items (Kumar, 2005a). In terms of successful and unsuccessful brand extensions, consumers reported their perceptions of the advanced functionality on the platform on a five-point scale (“was not successful at all/strongly successful”; Kumar, 2005a). Therefore, a score less than 3 represented a failure. We excluded any respondents who neither agreed nor disagreed that the product they considered was a successful extension.

5.1.4. Dependent variables

The dependent variables include product quality and user network effects. For product quality, we relied on items pertaining to whether the hypothetical product offered high quality, was good, and was useful (modified from Burnham *et al.* 2003; Kumar, 2005b). The measures for user network effects included, for example, “In the future, I expect this new product to have the most users,” “In the future, this new product will probably have a larger market share that any of its competitors,” and “Over the next few years, I expect the installed base for this new product to grow rapidly,” all measured on five-point agreement scales (Frels *et al.* 2003).

5.1.5. Data collection and analysis

With this data collection, we aimed to obtain 410 responses from randomly selected users, approached in cyber cafés. Of the 390 completed surveys gathered, 338 were usable, for a response rate of 86.7%. The overall sample demographics were as follows: 74.5% men and 25.5% women, ranging in age from 10 to 50 years (though the 21–30-year age group was dominant, accounting for 72.1%). With respect to the respondents' expenditures on leisure, 60.5% spent NT$2,000 to NT$10,000 (approximately US$63 to US$310) monthly.

The stimuli included 48 no branding, 162 solo branding, and 128 cobranding strategies. The 112 solo branding cases cited 46 failures and 66 successful cases, after excluding some cases due to incomplete answers. We combined the 46 failed and 66 successful solo branding strategies with the 111 cobranding strategies in Study 3, after excluding some cases due to incomplete answers.

The effects of gender, age, education, occupation, and personal expenditures were insignificant with regard to product performance and user networks of new products (Wilks' lambda by F-value) in each study. Therefore, we excluded these variables from further analysis.

5.2. Study 1

5.2.1. Design

Using a 2 (no branding versus solo branding) $\times$ 2 (product base: mobile phone versus television platform) between-subjects design, we tested H_1. The group sizes were as follows: no branding n = 36, solo branding n = 42, mobile phone n = 41, and television consoles n = 37.

5.2.2. Manipulation checks

The average scores for perceived brand value (α = 0.81) differed significantly between the unbranded (M = 3.34, SD = 0.12) and solo-branded (M = 3.65, SD = 0.11; F(1,74) = 3.58, p = 0.062) groups. Brand value for the solo brand on the television platform (M = 3.92, SD = 0.16) was greater than that for the unbranded version on that platform (M = 3.40, SD = 0.18; t(39) = 2.12, p = 0.04). Although brand value for the solo brand (M = 3.37, SD = 0.11) was greater than brand value for the unbranded version (M = 3.27, SD = 0.18; t(35) = 0.045, p > 0.1) on the mobile phone platform, the difference was not significant. The transferred cues for the solo-branded functionality thus appeared stronger than those for the unbranded functionality in the dedicated version.

5.2.3. Hypothesis tests

According to the Wilks' lambda by F-value results, the primary effects of the branding strategy (F = 4.70, p = 0.012) and base product (F = 3.48, p = 0.04), as well as their interaction (F = 5.21, p = 0.008), were significant with regard to product value (product quality α = 0.89; user network α = 0.84). Specifically, the revealed product value for an unbranded television console (product quality M = 3.48, SD = 0.19, user network M = 3.11, SD = 0.15) was significantly lower than that for a solo-branded television console (product quality M = 4.14, SD = 0.06; t(39) = -3.51, p < 0.001; user network M = 3.77, SD = 0.13; t(39) = -3.59, p < 0.001). In contrast, the product value for an unbranded mobile phone (product quality M = 3.35, SD = 0.13, user network M = 3.14, SD = 0.19) was insignificantly lower than that for a solo-branded mobile phone (product quality M = 3.38, SD = 0.11; t(35) = -0.98, p >0.1, user network M = 3.37, SD = 0.13; t(35) = -0.99, p >0.1). Thus, we confirm H_1: For a solo-branded extension of a high-performance base product, consumers prioritize the product performance dimension, and the effect of the solo-branded extension on their evaluations of the new product increases.

5.2.4. Discussion

The name assigned to an added, advanced functionality can convey the parent brand's value,

which may increase the value of the new product, especially if it is a dedicated version. The technological convergence between computers and television platforms suggests that a brand extension should feature an advanced functionality, such as online interactive media or social interaction within games. However, if the base product offers poor performance, the extension causes the consumer to focus on the convenience dimension, so the brand's effect on the new product disappears.

5.3. Study 2
5.3.1. Design

Using a 2 (solo brand extension: failure versus success) $\times$ 2 (product base: mobile phone versus television platform) quasi-experimental design, we tested whether customer evaluations of an extension improve when a brand extension is successful. This study thus included two brand groups, success (n = 66) or failure (n = 46), as well as the same two base product categories from Study 1.

5.3.2. Manipulation checks

We tested the effect of the extension on the basis of perceived associations, such that respondents reported their perceptions of the association of the attributes between the stimuli and the base product. The association for the failed extension (M = 3.48, SD = 0.09) was lower than that for the successful one (M = 4.04, SD = 0.06; F(1,109) = 23.15, $p < 0.00$), which in turn affected the brand. Furthermore, the average brand value scores ($\alpha = 0.80$) differed significantly between the success (M = 3.81, SD = 0.10) and failure (M = 3.45, SD = 0.07; F(1,109) = 9.02, $p = 0.003$) cases. That is, the association resulting from a successful brand extension was stronger than that for a failed extension, which results in greater brand value.

5.3.3. Hypothesis tests

According to the Wilks' lambda by F-value scores and a two-way analysis of variance, we uncovered significant main effects of the brand strategy (F = 5.55, $p = 0.005$) and base product (F = 6.61, $p = 0.002$), as well as their interaction (product quality $\alpha = 0.89$, user network $\alpha = 0.83$; F =0.80, $p > 0.1$), on product value. The significant main effect of the successful extension on product value indicated that the value of a failure (product quality M = 3.37, SD = 0.09, user network M = 3.12, SD = 0.10) was less than that of a successful extension (product quality M = 3.73, SD = .07; F(1,108) = 10.52 $p = 0.002$; user network M = 3.52, SD = 0.09; F(1,108) = 8.45, $p = 0.004$), in support of H_2. Customer evaluations of a new product were more favorable when the advanced functionality was a successful solo-branded extension, rather than a failed one.

5.3.4. Discussion

Regardless of whether consumers place more weight on performance or convenience (Han *et al.* 2009; Zhang *et al.* 2007), the successful launch of a solo-branded extension improves customer perceptions of the similarity between the parent and the extension products (Kumar, 2005a). Although if the base product offers poor performance, the brand effect on the new product is not supported, a firm that decides to use a brand extension should make sure that the extension is successful.

5.4. Study 3
5.4.1. Design

We use a 2 (solo branding versus cobranding strategy) $\times$ 2 (product base: mobile phone versus television platform) quasi-experimental design. We tested if an extension would be evaluated more favorably when a cobranding strategy applied to a converged version and a solo branding strategy served the dedicated version.

That is, in this study, the brand strategy could involve solo branding (*Lineages*) or cobranding (*Lineages—The Age of Empires*) for the introduction of the extension. We combined 46 failure and 66 successful solo-branding strategies. Therefore, the 219 participants in Study 3 considered two brand strategies, solo (n = 112) or cobranded (n = 111), and two base products, mobile phone (n = 109) or television platform (n = 110).

5.4.2. Manipulation checks

To check the manipulations, we asked the participants to report their perceptions of the association (α = 0.77) of the attributes between the hypothetical combined game in the computer network and the hypothetical extensions to the two base products. The association for the television platform (M = 3.54, SD = 0.09) was weaker than that for the mobile phone (M = 3.73, SD = 0.09; t(110) = -1.45, $p > 0.1$) in the cobranding condition, but this association was stronger for the television platform (M = 3.89, SD = 0.08) than for the mobile phone (M = 3.81, SD = 0.09; t(110) = 1.46, $p > 0.1$) in the solo-branding condition.

The average brand value scores (α = 0.82) differed only insignificantly between the solo (M = 3.63, SD = 0.04) and cobranding (M = 3.61, SD = 0.05; F(1,218) = 0.04, $p = 0.96$) groups. The brand value for the solo-branded strategy did not dominate that for the cobranded strategy. The significant effect of brand strategy on brand values reflected only the different versions. Finally, the brand value for the solo brand on the television platform (M = 3.71, SD = 0.07) was greater than that for the mobile phone (M = 3.51, SD = 0.08; t(110) = 2.44, p =0.02), whereas brand value was lower for the television platform (M = 3.42, SD = 0.09) than for the mobile phone (M = 3.82, SD = 0.07; t(110) = -3.20, $p = 0.002$) when we considered the cobranded strategy.

5.4.3. Hypothesis tests

According to the Wilks' lambda by F-value and a two-way analysis of product value (product quality α = 0.89; user network α = 0.83), the main effects of the brand strategy (F = 0.02, $p > 0.1$) and base product (F = 0.24, $p > 0.1$) on product value, as well as their interaction (F = 9.60, $p < 0.00$), were all significant.

The significant main effect (Figure 2) of the solo-branded extension for the television platform (product quality M = 3.76, SD = 0.07; user network M = 3.48, SD = 0.09) was greater than that for mobile phones (product quality M = 3.40, SD = 0.08; t(110) = 3.29, $p = 0.001$; user network M = 3.18, SD = 0.11, t(110) = 2.08, $p = 0.004$). Customer evaluations of a new product were more favorable when the advanced functionality was introduced using a solo branding strategy and represented a dedicated product versions.

The significant main effect of cobranded extensions for television (product quality M = 3.42, SD = 0.08; user network M = 3.14, SD = 0.09) was less than that for mobile phones though (product quality M = 3.74, SD = 0.07; t(110) = -2.79, $p = 0.006$; user network M = 3.56, SD = 0.11; t(110) = -3.12, $p = 0.002$), in support of H_3. Customer evaluations of a new product were more favorable when the advanced functionality used a cobranding strategy with a converged product version.

5.4.4. Discussion

The effects of the solo-branded and cobranded strategies on product evaluations differed, because consumers placed more weight on performance or convenience dimensions (Han *et al.* 2009; Zhang *et al.* 2007). In other words, an advanced functionality should use a cobranding strategy if the product is a converged version but a solo-branding strategy for dedicated versions. Thus, the subset of attributes for online role-playing games and real-time strategies (single player and campaign), together with connectivity among players, could effectively combine in new game for a mobile phone platform. The attributes of online role-playing games, which require real-time connectivity among players, are present on the television platform.

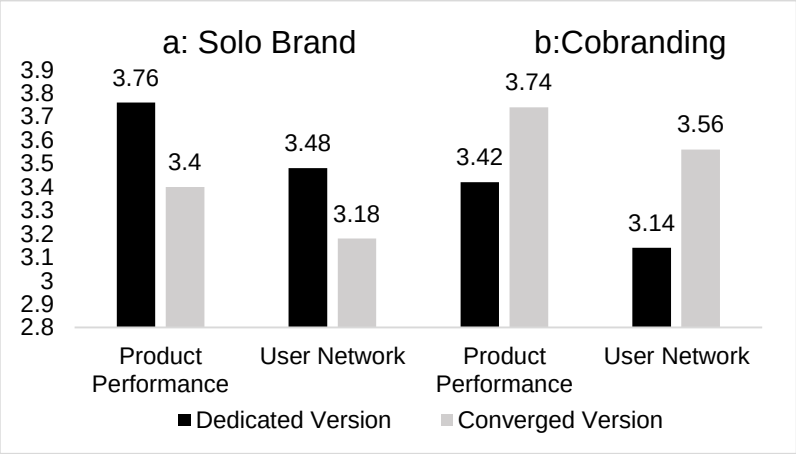

Figure 2. Brand Strategy Impacts on Product Value

6. Further tests

The variables in Figure 3 include brand value (i.e., strategy), product performance, user and complementary network effects, and purchase intensions. The dotted lines represent potential, previously tested relationships between the value of a product and consumers' purchasing intentions (Yeh, 2012). In addition, the bold, solid lines represent the predicted relationships of brand strategy effects on brand value for advanced functionalities and the value of a new product. Our three quasi-experimental studies supported these predictions; we also consider several complementary network effects and purchase intensions toward a new product.

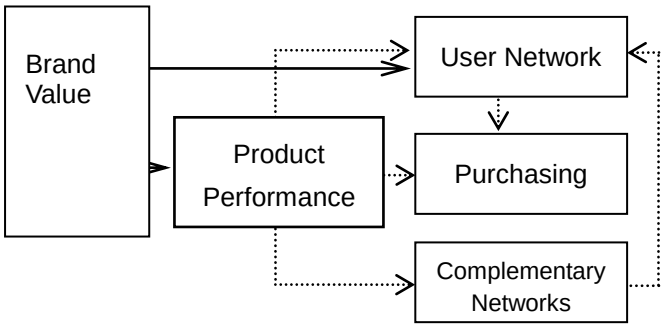

Figure 3. Conceptual Framework

The focal theoretical concept in Figure 3 comprises multiple paths. Because ordinary least squares estimates are conditional on other model variables (Song *et al.* 2005), they can produce misleading information about the relationships among variables. Therefore, to test for other relationships among the variables in Figure 3, we used path analysis with observable variables.

6.1. Variable measures

To measure complementary network effects for a new product, we relied on three items, measured on five-point agreement scales: (1) "Over the next few years, more and more hardware, software, skills, and support for my specific decision area will be compatible with this product"; (2) "In the future, I believe that this product will have more hardware, software, skills, and support than its competitors"; and (3) "Over the next years, I expect the amount of hardware, software, skills, and support to grow very rapidly for this product." For consumers' purchase

intentions, we also included the following items: (1) "I am not likely/very likely to buy this product" (Kumar, 2005b); (2) "What I get from this product falls short of what I expect for this price"; and (3) "This product meets your future needs" ("strongly disagree/strongly agree"; Burnham *et al.* 2003).

6.2. Analysis

In Table 1, we provide the results from the test for data normality, which uses the kurtosis statistics from the scales and their standard errors. Normality is not a problem; the kurtosis statistics of all scales are less than twice their standard error. For example, brand value shows a 3.64 average, with 0.67 as its standard error, and a 0.79 kurtosis value. Skewness ranged from -0.43 to 0.11, and kurtosis ranged from -2.01 to 0.79. These results indicated that the variables were well below the levels required for transformation (i.e., skewness < 2, kurtosis < 5; Ghiselli *et al.* 1981). In addition, all the correlations were below the cutoff value of .8 suggested by Bryman and Cramer (1994), so multicollinearity did not appear to be a concern.

When multiple indicators measure one construct, it is necessary to examine convergent validity according to the item-to-total correlations (ITC), composite reliability, and average variance extracted (AVE). The ITC should not fall below 0.3. Because the Cronbach's α estimates were all greater than 0.60, we found support for each construct's internal consistency (Bagozzi and Yi, 1988). The composite reliability values ranged from 0.87 to 0.93. In addition, in support of discriminant validity, the AVE of the latent variables was greater than the squared correlation between any two latent variables, as well as greater than 0.50 (Fornell and Larcker 1981). Thus, the scores fit the structural model, according to their convergent and discriminant validity.

Table 1. Correlation Coefficients among Independent, Dependent, and Other Variables

	Mean	SD	M1	M2	AVE/α	(1)	(2)	(3)	(4)	(5)
Brand value (strategy)	3.64	0.67	-0.21	0.79	0.78/0.90					
1. Product performance	3.59	0.64	-0.31	0.20	0.70/0.87	0.61**				
2. User networks	3.36	0.74	-0.43	0.43	0.73/0.93	0.51**	0.57**			
3. Complementary networks	3.49	0.70	-0.10	0.51	0.78/0.91	0.43**	0.41**	0.53**		
4. Purchase intensions	3.29	76	-0.38	0.63	0.78/91	0.43**	0.66**	0.54**	0.41**	
5. Base products(platform)	0.47	0.50	0.11	-2.01	n.s.	0.00	-0.05	0.03	0.04	-0.02

Notes: M1 = skewness; M2 = kurtosis; α = Cronbach's alpha; AVE = average variable extracted. **p < 0.01. *p < 0.05. n.s.: non-significant.

6.3 Model test

Overall, 109 respondents evaluated mobile phones (converged version), and 110 respondents evaluated the television platform (dedicated version). Holding the path coefficients, factor loadings, and error variances invariant across the base product, we found that each version of the model in Figure 3 achieved good overall fit with the observed data (χ^2 = 37.99, d.f. = 13, p = 0.0007; confirmatory fit index = 0.95; root mean square error of approximation = 0.08). The cross-validity of the two groups with moderating variable (i.e., different versions) existed in both models (p < 0.001).

For both dedicated and converged versions, purchasing intentions were positively associated with product performance and user network effects, which represented mediating variables for the complementary network effects. In addition, for the dedicated version, product performance positively affected the user (β = 0.35, p < 0.001) and complementary (β = 0.44, p < 0.001) network effects; the latter also increased the user network effects (β = 0.30, p < 0.001). Purchasing intentions toward the added functionality depended on the user network (β = 0.25, p

< 0.001) and product performance (β = 0.51, p < 0.001), according to the results in Table 2 and Figure 3. For the dedicated version, purchasing intentions were positively influenced by brand value through user network effects (0.17, p < 0.00) and product performance (0.63, p < 0.00), which added 4.25% (0.17 × 0.25) and 32.13% (0.63 × 0.51), respectively.

Table 2. Relationship of Brand Value, Product Value, and Purchase Intentions

Path coefficients (T-value) \ Types	Dedicated Version			Converged Version		
	Beta	SE	CR	Beta	SE	CR
Brand value→ Product performance	0.63	0.05	12.18	0.60	0.05	12.18
Brand value → User network effects	0.17	0.07	2.63	0.16	0.07	2.63
Product performance → Complementary network effects	0.44	0.06	7.05	0.38	0.06	7.05
Product performance→ User network effects	0.35	0.07	5.50	0.34	0.07	5.50
Complement network effects → User network effects	0.30	0.06	5.74	0.33	0.06	5.74
Product performance→ Purchase intension	0.51	0.07	9.27	0.52	0.07	9.27
User network effects → Purchase intension	0.25	0.06	4.62	0.27	0.06	4.62
χ^2/d.f.	37.99/ 132.86					

Notes: SE = standard error. CR = composite reliability.

7. Conclusion and discussion

A successful solo brand extension to establish an added functionality contributes to the value of a new product, through both product performance and the number of users. The value of a new product thus derives not just from the base product but also from the contributions achieved by the greater number of users, achieved through the added functionality. Depending on the influence of the added functionality, consumers prefer to its performance or convenience dimensions, which produces different brand effects for the new product. Successful solo-branded functionality dominates failed solo-branded functionality for both versions. In addition, successful solo-branded and an unbranded functionality contribute to the value of a new CP (e.g., mobile phone and iPad).

For a MMORPG, performance through a mobile phone is poorer than that through a television, which indicates that consumers prefer to recombine many convenience items (e.g., playing a single game with simple connection functions) from different products (i.e., cobranded strategy) in CPs. The choice pattern reverses for a high performance base product, in that consumers prefer sophisticated attributes (e.g., complex social interactions within online games) from a single parent in a dedicated product version.

Software developers exhibit ever-increasing abilities to write applications for products on new platforms. For example, social interaction tools in online games could be transformed to function on mobile phones and through televisions. Although the development speed for mobile phones generally has been faster than that for television platforms, a few examples already have emerged. We anticipate that such development will continue, so consumers should anticipate encountering additional advanced functionalities with network effects in dedicated versions (i.e., televisions). Such functionalities (e.g., online games) require real-time response technologies that can be shared among users, so high performance base products will be in great demand.

When designers and managers choose branding strategies to market the added functionalities of their new products, they need to consider the performance of the base product. For advanced functionalities and a high performance base product, consumers prioritize the performance dimension, rather than the convenience dimension. Thus, a solo-branding strategy is more effective for advanced functionalities. The opposite effects emerge for converged versions, for which a firm should use a cobranding strategy.

The results of this study suggest that an existing product ecosystem (Frels *et al.* 2003; Wang and Xie, 2011) can extend to include different functionalities. For example, firms might add functionalities that facilitate links with the number of users already playing. Single-player and

campaign attributes might not require real-time connectivity among players, but they could be present on mobile and television platforms.

This study used three quasi-experimental designs to test the effect of a brand strategy on consumers' perceptions of the value of a new product. Further research should test real, empirical cases and other functionalities. For example, cultural products, global positioning systems, and Facebook constitute promising added functionalities for the base product of web television (i.e., Internet access through a television). Further research also could test how existing owners of a base product respond to various brand strategies for different added functionalities when consumers evaluate a new version of a product.

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