Compared with other markets, those with competing technological standards exhibit certain fundamental characteristics that make a consumer's decision to adopt a new product more risky and more complex. This article examines how standards competition affects consumer behavior, an issue that has been relatively neglected by previous research in this area. The results show that consumers depend on different types of information in their adoption decisions and respond differently to advertising. Specifically, the authors find that standards competition motivates consumers to pay more attention to information that is comparative in nature. Thus, information about the relative (absolute) performance of a product has a stronger (weaker) impact on a product's share in markets with standards competition (Study 1). Standards competition also moderates the effectiveness of different advertising formats: It strengthens the effect of comparative advertisements but weakens the effect of noncomparative advertisements (Study 2). As a result, two commonly observed drawbacks of comparative advertisements—negative attitude toward the ad and source confusion—disappear in the presence of standards competition (Study 2), and comparative advertisements even induce greater confidence in the advertised brand (Study 3). Finally, in the presence of standards competition, the superiority of comparative advertisements is stronger when the advertised brand has a disadvantage in terms of brand familiarity than when it has an advantage (Study 3). This research takes a step toward a better understanding of these important but underexplored issues and provides managerial insights for firms that launch new products in markets with competing standards.

The Impact of Standards Competition on Consumers: Effectiveness of Product Information and Advertising Formats

With the rapid development of information technology and the digital revolution, technological standards have an increasingly important effect on the success of many new products and services, including computers, electronic video games, wireless communication, home networking, video/audio electronics, banking services, and the Internet (Katz and Shapiro 1994). A common feature of markets in which technological standards have become so important is that the consumption utility of a product or service increases with the number of people who use it. Economists call this demand interdependence “network externalities” (Farrell and Saloner 1986; Katz and Shapiro 1985) or “network effects” (Chou and Shy 1992). Standards competition is common in the presence of network effects because the product feature that creates the network usually requires a technical protocol, which is often patent protected. In the early stages of market development, competitors may simultaneously introduce products based on incompatible patented technologies. Standards competition may also occur either because an incumbent refuses to license its technology to a new entrant or because the cost to achieve compatibility is so high that the entrant prefers to introduce its own technology.

Over the past two decades, there have been many fierce standards battles between incompatible technologies (Shapiro and Varian 1998). Some well-known examples are those for the VCR between Matsushita’s VHS and Sony’s Betamax formats, for streaming audio and video software
between Microsoft and RealNetworks, for 56k modems between 3Com and Rockwell/Lucent, and for Internet browsers between Microsoft and Netscape. In addition, there are many ongoing standards battles in various new product markets, such as home networking, wireless communication, expansion devices for portable electronics, online music-sharing software, recordable DVD, ultra-wideband, and digital music.

Standards battles and network effects have generated a considerable amount of research. For example, economists have examined the social welfare implications of standards competition and have analyzed associated issues of regulatory policy (e.g., Economides 1996; Farrell and Saloner 1986; Katz and Shapiro 1985). Researchers have also explored strategic issues, such as pricing (Dhebar and Oren 1985), compatibility (Xie and Sirbu 1995), upgrades (Padmanabhan, Rajiv, and Srinivasan 1997), complementary products diffusion (Gupta, Jain, and Sawhney 1999), diffusion acceleration (Van den Bulte 2000), asymmetric network effects (Shankar and Bayus 2003), product line (Sun, Xie, and Cao 2004), cross-market network effects (Chen and Xie 2003), pioneer survival (Srinivasan, Lilien, and Rangaswamy 2004), indirect effects (Nair, Chintagunta, and Dube 2004), and intrastandard competition (Wang and Xie 2005).

Although existing research has examined standards battles from both societal and firm perspectives, the consumer’s perspective has received little attention. The literature has provided little theory or evidence on how consumers might behave in markets with standards battles. Compared with other markets, those with standards battles exhibit certain fundamental characteristics that make the consumer’s new product adoption decision more risky and complex. First, the expected utility of product adoption in these markets is largely determined by the standard’s future installed base, which is highly uncertain in the early stages of the standard’s introduction. Second, the adoption decision is also more complicated because consumers often must choose not only among brands but also among competing technological standards (e.g., Nintendo versus Sega systems for video game players, DVD versus DivX systems for digital videodisk players, Apple’s iTunes versus Microsoft’s MSN Music for online music). Finally, adoption of a “losing” standard can be costly to consumers (e.g., to owners of the Betamax VCR and the DivX digital video player). For these reasons, consumers may behave differently in markets with standards battles than in those without. They may search for different types of information, use different criteria to evaluate and compare alternatives, engage in different decision-making processes, and respond differently to advertising. Another limitation of research on standards competition and network effects is the dearth of research on firm communication strategies. Given the high uncertainty and extreme complexity of consumers’ adoption decisions in markets with standards battles, it is crucial for firms to communicate effectively with consumers about the value of their products and to build consumer confidence in their future market growth.

In this article, we ask and answer four specific research questions: (1) Does standards competition affect the likelihood of consumer new product adoption? (2) Does standards competition affect the importance that consumers place on different types of performance-related product information? (3) Because advertising is often used to convey performance-related information, how does standards competition affect consumer response to various advertising formats, and which advertising format is most effective in winning a standards battle? and (4) Does consumer familiarity with the advertised and comparison brands moderate the effectiveness of various advertising formats in markets with standards competition?

To address these questions, we designed three studies. Study 1 was motivated by the commonplaceness of expressing consumption utility in both absolute and relative terms. We examine the effect of standards competition on consumers’ adoption decisions and the relative importance in such decisions of two types of performance-related information: absolute and relative product performance. Building on the results from Study 1, Study 2 investigates the interaction between standards competition and the effectiveness of three different advertising formats: direct comparative, indirect comparative, and noncomparative. Study 3 investigates the moderating effect of consumer brand familiarity on the effectiveness of advertising formats in markets with competing standards. We discuss the three studies in the next three sections. After presenting the results of the three studies, we conclude by summarizing our findings, interpreting their implications, and discussing limitations and avenues for further research.

**STUDY 1**

Study 1 addresses two issues: First, we investigate how a standards battle affects a consumer’s new product adoption decision. Specifically, does an ongoing standards battle reduce the consumer’s likelihood of adopting a new product? A standards war increases consumer uncertainty early in the life cycle of the product because the value of a product is determined not by its quality alone but also by the outcome of the standards war (Klopfenstein 1989; Van den Bulte 2000). Although the outcome of standards battles has a strong impact on consumers, there is no way for consumers to predict that outcome accurately. Consequently, consumers may defer making a choice and may even forgo product adoption altogether (see, e.g., Dhar 1997; Tversky and Shafir 1992; Van den Bulte and Stremersch 2004). Thus, as a face validity check, we hypothesize the following:

**H1**: Consumers are less likely to adopt a new product in the presence of standards competition than in its absence.

The second and more important issue in Study 1 pertains to the effect of standards competition on the importance that consumers place on different types of performance-related product information. Often, consumers actively seek information about the performance of products they intend to buy to predict the consumption utility of those products. Consumption utility can be expressed in both absolute and relative terms, as economics and decision-making research have clearly shown. Absolute utility, which is sometimes described as “choiceless” utility (Loomes and Sugden 1982), is the utility associated with the consumption of a particular good, independent of other available alternatives. Relative utility is the differential consumption utility of a good relative to other available alternatives.

Utility theory suggests that when consumers face two alternative product offerings, X and Y, they will choose Product X if two conditions hold: (1) a positive absolute utility of X and (2) a positive relative utility of X over Y.
Information about product performance can help consumers evaluate the two utility conditions, and this information also can be expressed in absolute or relative terms. In general, consumers value information about both absolute and relative performance of a product because it is predictive of the product’s underlying absolute and relative utility.

However, we propose that consumers give greater weight to information about the relative performance of a product in the presence of standards competition than in its absence. Findings from several streams of literature suggest that in the face of uncertainty, decision makers become considerably more sensitive to information that compares choice alternatives. For example, the reason-based choice paradigm suggests that in the face of uncertainty, decision makers tend to evaluate the consequences both of choosing one alternative and of forgoing the other (Inman, Dyer, and Jia 1997; Shafir and Tversky 1992). Regret theory (e.g., Loomes and Sugden 1982) and the literature on decision making under uncertainty (e.g., Lipshitz and Strauss 1997) also make similar claims. Likewise, in the face of standards competition, consumers often are uncertain about which of the competing products will eventually win the battle. It is likely that consumers resolve such uncertainty by carefully weighing the pros and cons of adopting one standard over another. Thus, information about the relative performance of a product should have a greater impact on consumer adoption decisions in the presence of a standards war than in its absence.

We also propose that standards competition may decrease the value of information about the absolute performance of a product, given that “winner-takes-all” scenarios are likely in such markets. In the presence of standards wars, the value of information depends greatly on whether it can help consumers predict the winner. Product information that helps consumers predict the winner is highly valued, whereas product information that is a poor predictor of the winning standard is devalued. Because absolute product performance is an unreliable predictor of the winning standard (Klopfenstein 1989), consumers are likely to give less weight to information about it in markets with standards competition than in those without. Formally, we hypothesize the following:

\[ H_2: \text{The impact of information about the relative performance of a product on consumers’ adoption decisions is stronger in markets with standards competition than in those without it.} \]

\[ H_3: \text{The impact of information about the absolute performance of a product on consumers’ adoption decisions is weaker in markets with standards competition than in those without it.} \]

Procedure and Stimuli

A total of 181 undergraduate students participated in a computer-based experiment with a 2 (standards wars: present or absent) \( \times \) 2 (absolute ratings: high or low) \( \times \) 2 (relative ratings: high or low) between-subjects design. We chose videophones as the experimental product for two reasons: (1) Participants did not have strong existing opinions about the product, and (2) they would not automatically assume the existence of a standards battle. Videophones also have the “software” and “hardware” characteristics that are typical of product categories with standards competition. The experimental procedure consisted of the following steps:

**Step 1.** We briefed the participants about the experimental session. The computer terminals randomly assigned participants to any one of the eight experimental conditions.

**Step 2.** Participants then read a description of a new product-market (videophones). Depending on the condition to which participants were assigned, they read either the “no-standards-war” description or the “standards-war” description (see Figure 1, Panel A). The first two paragraphs were identical for both descriptions and introduced the participants to the new product, the key attributes of this product, and the two competing firms (Connec and Dwyer) that produced it. We manipulated the presence or absence of a standards war by the third and fourth paragraphs in the description. We told participants who were assigned to the standards-war conditions that the two competing brands were incompatible with each other, that analysts expected a “standards battle” between the two brands, and that there was considerable uncertainty about the outcome of this battle. We told participants who were assigned to the no-standards-war conditions that the two competing brands were compatible with each other, that analysts expected a “battle” between the two brands, and that there was considerable uncertainty about the outcome of this battle. Thus, the key difference between the two descriptions was the presence or absence of compatibility between the brands.

**Step 3.** After the participants read the previous section to their satisfaction, we gave them a choice task. Participants saw one of the four possible choice scenarios (see Figure 1, Panel B). We told them that they would be given “overall” ratings from Consumer Reports for the two products. The brands were shown on an 11-point scale, and the ratings were described in a sentence (see, e.g., Figure 1, Panel C). The key manipulations involved varying Connec’s absolute ratings (i.e., the star rating directly associated with Connec) and relative ratings (i.e., the difference in the star ratings of Connec and Dwyer). For example, consider the condition in which Connec received an eight-star rating and Dwyer received a seven-star rating (see Figure 1, Panel B). Here, Connec’s absolute and relative ratings were eight stars and one star, respectively. The absolute rating of Connec was varied at two levels (i.e., eight stars or ten stars). The relative rating of Connec was also varied at two levels (i.e., a difference of one star or a difference of three stars). The design ensured that the absolute (relative) rating of Connec was held constant when its relative (absolute) rating was varied. The focal brand, Connec, was the higher-rated and more expensive brand (Connec = $120, Dwyer = $80) in all four choice scenarios. In each case, we gave participants the option to defer their decision for a later occasion, to choose the focal brand (Connec), or to choose the other brand (Dwyer). We also asked them to answer a manipulation check question.

**Results**

We estimated a binomial logistic regression model with effects coding to test all three hypotheses simultaneously. The estimated model is as follows:

\[
P(\text{ADOPT}) = \Lambda(\beta_0 + \beta_1 \times \text{SWAR} + \beta_2 \times \text{RELATIVE} + \beta_3 \times \text{ABSOLUTE} + \beta_4 \times \text{RELATIVE} \times \text{SWAR} + \beta_5 \times \text{ABSOLUTE} \times \text{SWAR})
\]
Due to recent technological breakthroughs in sending voice and video over a POTS (plain old telephone system) line, a consumer market for video telephones has now emerged. Seeing the people you call may soon become an everyday reality. Currently, in the video telephone industry, there are two main players: Conmec Systems and Dwyer Technologies. The Conmec and Dwyer videophones are totally compatible with each other. Users of the Conmec brand of videophone will be able to communicate with the users of Dwyer brand of videophones, and vice versa. Software functions such as message recording and image editing for Conmec systems will work with messages and images from Dwyer systems. Analysts predict a market share battle. As of now there is a lot of uncertainty about which brand will eventually have a higher market share.

**Table 1**

<table>
<thead>
<tr>
<th>Standards War Description</th>
<th>Low Absolute Rating</th>
<th>High Absolute Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low relative rating</td>
<td>Dwyer = 7, Conmec = 8</td>
<td>Dwyer = 9, Conmec = 10</td>
</tr>
<tr>
<td>High relative rating</td>
<td>Dwyer = 5, Conmec = 8</td>
<td>Dwyer = 7, Conmec = 10</td>
</tr>
</tbody>
</table>

**C: Choice Scenario Example**

*Instruction:* We would now like you to make a product choice. Below we will provide you information on two videophone brands. To help you with your decision, we will also provide you with some information from Consumer Reports regarding these two brands.

Q: Provided below is the “Overall Rating” of two videophones, reproduced from the Consumer Reports table published in a recent issue of JEC (Journal of Electronics & Communication). The “Overall Rating” considers all possible aspects related to the product experience, ranging from actual physical performance of the machine to more indirect, market-related factors. Based on the 11-point “star-scale,” the brands were rated as follows:

<table>
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<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dwyer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conmec</td>
<td></td>
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</table>

Thus, Conmec ($120) got an 8-star rating, while Dwyer ($80) got a 7-star rating.

Now based on this information and all that you have read about the videophone industry till now, which of the following choice options given below would you prefer? Please click on the appropriate button.

1. Choose Conmec, OR
2. Choose Dwyer, OR
3. Defer Choice for a later occasion.

\[
+ \beta_6 \times \text{RELATIVE} \times \text{ABSOLUTE}
\]
\[
+ \beta_7 \times \text{ABSOLUTE} \times \text{RELATIVE} \times \text{SWAR},
\]

where P(ADOPT) is the probability that participants adopt the new product (i.e., choose Conmec or Dwyer). SWAR is a dummy variable that indicates the absence or presence (−1 or +1) of a standards war, RELATIVE is a dummy variable that indicates whether the relative rating of Conmec is low or high (−1 or +1), ABSOLUTE is a dummy variable that indicates whether the absolute rating of Conmec is low or high (−1 or +1), and Λ is the logistic cumulative density function. Table 1, Panel A, presents the choice count and share (in parentheses) for each choice option.

Adoption rates (H1). H1 suggests that standards competition damps new product adoption, which is supported by the data (\( \beta_1 = -.82, SE = .20 \); Wald \( \chi^2(1, N = 181) = 16.27, p < .01 \)). As Table 1, Panel B, shows, the adoption rate was higher in the absence of a standards war (80%) than in its presence (51%).

Information about relative performance (H2). H2 suggests that the presence of standards competition strengthens the impact of information about relative performance. This prediction was supported by a significant interaction term (\( \beta_4 = .35, SE = .20; \text{Wald} \chi^2(1, N = 181) = 2.94, p < .10 \)). This positive moderating effect is also apparent from the simple main effects. An increase in relative rating increases adoption rates in both cases: With a standards war, parameter estimate (B) = 2.28, SE = .49; Wald \( \chi^2(1, N = 91) = 21.79, p < .01 \), and without a standards war, B = 1.17, SE = .57; Wald \( \chi^2(1, N = 90) = 4.17, p < .05 \). However, this “increase” in new product adoption is greater in the presence of a standards war (ADOPTlow relative rating = 24%,
Table 1
STUDY 1 RESULTS

A: Choice Count and Share (in Parentheses) for Each Choice Option

<table>
<thead>
<tr>
<th>Count (%) for Each Choice Option</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N = 23</td>
<td>N = 22</td>
</tr>
<tr>
<td>Relative rating</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>Conmec: 9 (39%)</td>
<td>Conmec: 15 (68%)</td>
</tr>
<tr>
<td></td>
<td>Dwyer: 3 (13%)</td>
<td>Dwyer: 5 (23%)</td>
</tr>
<tr>
<td></td>
<td>Defer: 11 (48%)</td>
<td>Defer: 2 (9%)</td>
</tr>
<tr>
<td>High</td>
<td>Conmec: 15 (65%)</td>
<td>Conmec: 16 (73%)</td>
</tr>
<tr>
<td></td>
<td>Dwyer: 5 (22%)</td>
<td>Dwyer: 4 (18%)</td>
</tr>
<tr>
<td></td>
<td>Defer: 3 (13%)</td>
<td>Defer: 2 (9%)</td>
</tr>
</tbody>
</table>

B: H1: Impact of Standards Competition on Category Adoption

Category adoption: Without standards war: 72 (80%)
With standards war: 46 (51%)

C: H2: Impact of Relative Performance on Category Adoption

Relative Ratings

D: H3: Impact of Absolute Performance on Category Adoption

ADOPT_{high relative rating} = 76%, a 52% increase) than in the absence of a standards war (ADOPT_{low relative rating} = 71%, ADOPT_{high relative rating} = 89%, an 18% increase), thus confirming H2 (see Table 1, Panel C).

Information about absolute performance (H3). H3 suggests that the presence of standards competition weakens the impact of information about absolute performance. The interaction term, ABSOLUTE × SWAR, was not significant, and thus H3 is not supported (β₈ = −.28, SE = .20; Wald χ²(1, N = 181) = 1.84, p > .10). However, the main effects are in the predicted direction, even though the interaction term failed to achieve significance (see Table 1, Panel D).

Discussion

The evidence from Study 1 suggests that standards competition moderates the effect of both absolute and relative ratings on the choice shares of the focal brand. A higher relative rating leads to an increase in new product adoption both in the presence and in the absence of a standards war,
but this increase is greater in the presence of a standards war than in its absence. This implies that standards competition strengthens the impact of information about relative product performance. Conversely, higher absolute ratings lead to an increase in new product adoption in the absence of standards competition but not in its presence, which provides some evidence of a negative moderating effect of standards competition on the impact of information about absolute performance. Furthermore, in a manipulation check, we asked participants to indicate the extent to which they paid more attention to the relative ratings of the brands than to the corresponding absolute ratings in making their decision. Participants reported greater use of relative judgments in the presence of a standards war ($M = 5.7$) than in its absence ($M = 5.0$; $F(1, 179) = 5.43, p < .05$). The manipulation check further confirms our claims.

**STUDY 2**

Although Study 1 demonstrates the importance of information about the relative performance of products in standards markets, the implications of this finding for designing marketing communications are less clear. Study 1 suggests that consumers value marketing communications that convey information about the relative performance of a target brand. One way to convey information about the relative performance of a product is to use ad formats that are comparative in nature. Would the increased value of information about relative performance lead to a greater preference for comparative ad formats than for noncomparative ad formats? More specifically, in the presence of standards competition, are comparative formats more effective than noncomparative formats in inducing consumers to adopt the advertised brand? We address these research questions in the current study.

Although the consumer’s adoption decision is a key variable of interest, it is also important to know how the ad format affects consumer cognitions about the advertisement and the brand (e.g., attitude toward the ad, differentiation). On the basis of data from Study 1 and prior research on comparative advertising (Grewal et al. 1997), we identified three such cognitive and affective variables of importance. Of special interest to us is the possible moderating role of standards competition; that is, does the presence of a standards war alter the effect of the ad format on consumer cognitions? This is important because prior research on comparative advertising manipulated neither the presence of standards competition nor the concomitant uncertainty.

The first variable of interest is “confidence” in the advertised brand. Prior research suggests that comparative advertisements do not affect confidence in brand claims (e.g., Grewal et al. 1997). However, Study 1 seems to suggest that in the presence of standards competition, comparative formats could affect confidence in the advertised brand. Recall that Study 1 showed that the presence of a standards war resulted in greater impact of information about relative performance of products, which in turn led to higher choice shares. These results indirectly suggest that in the presence of a standards war, information about relative product performance creates greater confidence in the target brand. Because comparative ad formats tend to provide information about relative performance of the advertised product, whereas noncomparative ad formats typically do not, there will likely be greater confidence in the advertised brand when the format is comparative than when it is noncomparative. Thus, we hypothesize that the presence of a standards war positively moderates the effect of comparative advertisements on confidence in the advertised brand.

The second variable we examine is “attitude toward the ad.” Prior research has shown that comparative formats can be less effective than noncomparative formats as a result of the generation of negative affect because consumers often find such advertisements offensive and irritating (see, e.g., Pechmann and Ratneshwar 1991). In turn, negative affect or ad-evoked feelings often lead to source derogation, discounting of the ad message, and negative attitude toward the ad and the advertised brand (Brown, Homer, and Inman 1998). As a result, consumers may view the advertised brand unfavorably (Batra and Ray 1986). In contrast, noncomparative advertisements do not generate negative affect, because they avoid comparison between brands (Grewal et al. 1997). We expect that the presence of a standards war moderates this effect. We conjecture that comparative advertisements do not generate negative affect in the presence of a standards war, because (1) consumers actively look for information about relative product performance (see, e.g., Study 1) and (2) comparative ad formats provide information about relative product performance. Thus, we hypothesize that the “informational” aspect of the comparative advertisement (i.e., information about relative product performance) shifts attention away from its “affective” aspect (i.e., an offensive tone).

The third variable of interest is “association heuristics.” Prior research indicates that comparative formats often invoke association heuristics (Chaiken 1987). According to this theory, the very act of comparing two (or more) brands reinforces consumers’ beliefs in the similarity of these brands, often leading to sponsor misidentifications (e.g., Pechmann and Stewart 1990). Consequently, consumers invoke a heuristic that leads them to believe that if two brands are being compared, the brands must be similar. By avoiding any comparison, noncomparative advertisements do not invoke this heuristic. Several studies (e.g., Gorn and Weinberg 1984; Grewal et al. 1997; Pechmann and Ratneshwar 1991) document this unintended associational effect of comparative advertising. We hypothesize that the presence of a standards war suppresses such heuristic processing associated with comparative advertisements. Our hypothesis is predicated on the notion that participants’ motivational states have a strong influence on the use of heuristics. Prior research shows diminished heuristic processing when decision makers are strongly motivated to process information (Eagly and Chaiken 1993, p. 305). Recall that in Study 1, we found that participants exposed to a standards war were strongly motivated to look for a particular type of information (i.e., information about relative performance). Therefore, we expect diminished use of association heuristics in the presence of a standards war.

Finally, we address the key issue of how comparative ad formats affect adoption of the advertised brand. On the basis of Study 1’s results and our discussion about the impact of standards competition on cognitive and affective variables, we expect that the presence of a standards war has a positive moderating effect on the relationship between comparative ad formats and brand adoption. We also predict a similar moderating relationship for perceived performance of the advertised brand, a continuous proxy measure for brand adoption behavior. In summary, we present the following hypotheses:

$H_2$: The presence of standards competition moderates the effect of ad format on cognitive and affective variables. Specifi-
cally, moving from noncomparative to comparative advertise-
ments is more likely to (a) increase confidence, (b) reduce negative affect, and (c) suppress association heuris-
tics in the presence of standards competition than in its absence.

H₃: The presence of standards competition moderates the effect of ad format on consumers’ adoption decisions. Specifically, moving from noncomparative to comparative advertise-
ments is more likely to (a) increase adoption of the advertised brand and (b) increase its perceived performance in the presence of standards competition than in its absence.

In addition, we also examine whether the cognitive and affective variables act as mediators.

Results

Table 2 presents the results of Study 2. We discuss our key findings by focusing on the comparisons of direct comparative and noncomparative formats. Other compar-
sions can be inferred from Table 2. For all other detailed statistical results, we refer readers to the work of Chakravarti and Xie (2005). We now examine how our manipulations affected each of the variables we discussed previously. In addition, hereinafter, we use SW and SW to refer to the case with and without standards competition, respectively.

Confidence. The standards war manipulation interacted with the ad format manipulation for confidence ratings (F(2, 89) = 3.45, p < .05). The confidence measures were unaffected by the ad format under SW. However, they were affected by the ad format under SW (F(2, 45) = 6.00, p < .01). In the presence of standards competition, the direct comparative format created more confidence in the advertised brand than did the noncomparative format (MₑDC = 5.3, MₑNC = 3.4; F(1, 45) = 11.02, p < .01). This result confirms H₄a.

Attitude toward the ad. The standards war manipulation also interacted with the ad format manipulation for the attitude-toward-the-ad ratings (F(2, 89) = 3.65, p < .05). Compared with the noncomparative format, the direct comparative format worsened the attitude toward the ad under SW (MₑNC = 6.9, MₑDC = 4.8; F(2, 44) = 13.28, p < .01), but it did not generate any negative affect under SW (F(2, 45) = .04, p > .10). Thus, H₄b is also supported.

Similarity. The standards war manipulation also interacted with the ad format manipulation for the similarity ratings (F(2, 89) = 13.40, p < .01). In comparison with the noncomparative format, the direct comparative format provided less differentiation (i.e., higher similarity ratings) under SW (MₑNC = 4.8, MₑDC = 5.9; F(2, 44) = 7.10, p < .01), but it provided more differentiation (i.e., lower similarity ratings) under SW (MₑNC = 6.8, MₑDC = 4.7; F(1, 45) = 19.89, p < .01). These results are consistent with H₄c.

Choice share. The standards war manipulation also interacted with the ad format manipulation for the focal brand choice shares (B = 1.77, SE = .55; Wald χ²(1, N = 95) = 10.09, p < .01). Although the ad format manipulation affected choice shares both with and without standards competition, these effects were in opposite directions. Under SW, the choice share of the advertised brand is the lowest (31%) when the ad format is direct comparative and the highest (63%) when the ad format is noncomparative. Under SW, the choice share is the highest (69%) when the ad format is direct comparative and the lowest (19%) when the ad format is noncomparative. The disadvantage of the direct comparative ad format under SW (B = −.65, SE = .37; Wald χ²(1, N = 47) = 3.04, p < .10) and the advantage of the directive comparative ad format under SW (B = 1.12, SE = .41; Wald χ²(1, N = 32) = 7.25, p < .01) support H₄a.

Performance. Finally, the standards war manipulation interacted with the ad format manipulation for performance ratings (F(2, 89) = 23.04, p < .01). The performance measure presents a similar pattern as the choice share measure. The noncomparative ad format led to higher performance ratings under SW (MₑNC = 6.7, MₑDC = 4.9; F(2, 44) = 8.30, p < .01), but the reverse is true under SW (MₑNC = 4.6, MₑDC = 6.8; F(1, 45) = 34.09, p < .01). Thus, H₄b is also supported.

Mediation analysis. A multiple mediator model (MacKinnon 2000) with performance ratings as the dependent variable shows some evidence of mediation. In the absence of a standards war, attitude toward the ad mediates the influence of ad format on performance (B = −1.74, p < .05).
In the presence of a standards war, similarity ratings have a more modest mediating effect on the influence of ad format on performance ($B = 1.35$, $p < .10$). In summary, we find support for a mediating role of attitude toward the ad in the absence of a standards war and a mediating role of similarity ratings in the presence of a standards war.
### Table 2
#### STUDY 2 RESULTS

<table>
<thead>
<tr>
<th>Ad Formats</th>
<th>With Standard Wars</th>
<th>Without Standard Wars</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Direct Comparative</td>
<td>Indirect Comparative</td>
</tr>
<tr>
<td>(N = 16)</td>
<td>(N = 16)</td>
<td>(N = 16)</td>
</tr>
<tr>
<td>Choice Shares</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Defer choice (%)</td>
<td>31</td>
<td>50</td>
</tr>
<tr>
<td>Advertised brand (%)</td>
<td>69</td>
<td>44</td>
</tr>
<tr>
<td>Confidence measures</td>
<td>5.3</td>
<td>4.6</td>
</tr>
<tr>
<td>Attitude toward the ad</td>
<td>5.9</td>
<td>6.1</td>
</tr>
<tr>
<td>Similarity ratings</td>
<td>4.7</td>
<td>5.6b</td>
</tr>
<tr>
<td>Performance ratings</td>
<td>6.8</td>
<td>6.0a</td>
</tr>
</tbody>
</table>

aCell means differ from direct comparative means ($p < .05$).
bCell means differ from direct comparative means ($p < .10$).
cCell means differ from indirect comparative means ($p < .05$).

### Discussion

In summary, Study 2 shows that standards competition positively moderates the effect of comparative ad formats on several cognitive, affective, and outcome variables. First, the presence of a standards war moderates how the comparative and noncomparative ad formats affect consumer cognitions and affective reactions. In the presence of a standards war, comparative ad formats generate more confidence in the advertised brand, provide better differentiation, and do not generate negative affect. In contrast, in the absence of a standards war, comparative formats generate negative affect, invoke association heuristics, and do not affect confidence in the advertised brand. Second, the presence of a standards war also moderates how the ad formats affect consumer adoption decisions. In the presence of a standards war, comparative ad formats induce better adoption rates and performance ratings than noncomparative formats. In the absence of a standards war, noncomparative formats induce better adoption rates and performance ratings than comparative formats. Finally, the mediation analysis implicates two variables in a causal role. It appears that in the presence of a standards war, comparative ad formats are more effective because of the superior differentiation they provide. In contrast, in the absence of a standards war, comparative ad formats are less effective because of the negative affect they generate.

#### STUDY 3

In Study 2, we argued that comparative advertisements are more effective in a market with standards wars because they reduce prior uncertainty about the advertised brand by providing information about the product’s relative performance. In other words, it appears that consumers use the information in an advertisement to update their priors about the relative performance of the advertised brand. If the key function of a comparative format is to reduce prior uncertainty about the advertised brand’s relative performance and its ability to win the standards war, manipulation of these priors should enable us to test this process explanation.

Because consumers often use brand names to predict the performance of new products (Janiszewski and Van Osselelaer 2000), a way to manipulate these priors is to vary the familiarity of the advertised brand relative to the comparison brand. For example, consider a market in which a standards battle is being fought between a familiar, well-known brand and an unfamiliar brand. In such a market, all else being equal, consumers are likely to believe that a well-known brand has a greater chance of winning the standards
consider two specific situations: (1) The advertised brand is the well-known brand, and the comparison brand is the unfamiliar one; and (2) the advertised brand is the unfamiliar brand, and the comparison brand is the well-known one. If our process explanation regarding the uncertainty-reducing role of a comparative advertisement holds true, the comparative ad format is likely to have much less of an impact in the former situation than in the latter. Because uncertainty about the advertised brand’s ability to win the standards battle is much greater in the second situation than in the first, it is likely that the comparative advertisements will have a much greater impact in the latter situation than in the former. In other words, when the advertised brand is familiar (and the comparison brand is unfamiliar), the information in the comparative advertisement is in line with the priors and therefore is likely to have a much weaker effect than when the advertised brand is unfamiliar (and the comparison brand is familiar); when the advertised brand is unfamiliar, the information in the comparative advertisement updates the priors by providing different information from that previously held.

However, if our process explanation does not hold, the effectiveness of comparative ad formats should not vary as a function of this prior uncertainty. Conversely, a different pattern of results could emerge. For example, it is possible that participants may rely solely on the familiarity of the advertised brand in judging the credibility of the claim. In this case, the familiar brand’s claim would be regarded as more credible than that of the unfamiliar brand (e.g., Grewal et al. 1997). We would then observe greater effectiveness of the comparative formats when the advertised (comparison) brand is familiar (unfamiliar), a result that is inconsistent with our process explanation and contrary to our hypothesis. Unlike Study 2, in Study 3, we varied the familiarity of the two brands to verify the uncertainty-reducing role of comparative ad formats. Formally, we hypothesize the following:

\[ H_0: \text{In the presence of standards competition, (a) the benefit of moving from a noncomparative to a comparative ad format is greater if the advertised brand is at a disadvantage than if it is at an advantage in terms of familiarity relative to the comparison brand, and (b) confidence in the advertised brand mediates the relative superiority of the comparative formats over the noncomparative formats.} \]

**Stimuli, Design, and Procedure**

We tested our proposition in a 2 (familiarity of advertised brand versus comparison brand) × 3 (ad format) between-subjects experimental design. Note that a standards war was present in all conditions. A total of 95 undergraduate students from a subject pool received extra credit for participating in the study. Again, the product was videophones. We randomly assigned participants to one of the six experimental conditions. The first and second steps were identical to those of Study 2, except that the brand names used were Philips and Conmec. In the third step, participants saw an advertisement for a target brand. There were two key manipulations here. First, in three conditions, we used an unknown brand (Conmec) as the advertised brand and a relatively well-known brand (Philips) as the comparison brand. In the other three conditions, we used the relatively well-known brand (Philips) as the advertised brand and the unknown brand (Conmec) as the comparison brand. Second, the advertisements were in one of three formats: direct comparative, indirect comparative, or noncomparative. After the participants reviewed the advertisements, they completed the fourth step, which was identical to that of Study 2.

**Results**

Table 3 contains the cell means for all measures. For the sake of brevity, we discuss only the key results; again, we refer readers to the work of Chakravarti and Xie (2005) for more details. As we hypothesized, the relative familiarity of the advertised brand moderated the efficacy of the comparative formats (B = −1.09, SE = .60; Wald \( \chi^2(1, N = 95) = 3.31, p < .10 \)). When the advertised brand was unfamiliar (Conmec) and the comparison brand was familiar (Philips), the proportion of participants who chose the advertised brand in the direct comparative format was greater than the corresponding proportion in the noncomparative format (direct comparative = 44%, noncomparative = 6%; B = 1.22, SE = .57; Wald \( \chi^2(1, N = 32) = 4.57, p < .05 \)). When the advertised brand was familiar (Philips) and the compar-

<table>
<thead>
<tr>
<th>Ad Brand (Conmec) Is Less Familiar (High Prior Uncertainty)</th>
<th>Ad Brand (Philips) Is More Familiar (Low Prior Uncertainty)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ad Formats</strong></td>
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</tr>
<tr>
<td>Direct Comparative (N = 16)</td>
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</tr>
<tr>
<td>Indirect Comparative (N = 16)</td>
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<tr>
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</tr>
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<td>38</td>
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<td>5.8</td>
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</tr>
</tbody>
</table>

\[ a^{\text{Cell means differ from direct comparative means (}p < .05\text{).}} \]

\[ b^{\text{Cell means differ from indirect comparative means (}p < .10\text{).}} \]
son brand was unfamiliar (Conmec), the choice share of the advertised brand did not differ across the ad formats. This supports H6a.

For performance ratings, there was also an interaction between the ad format and the familiarity manipulations (F(2, 89) = 7.08, p < .01). In the condition in which the advertised brand was relatively unfamiliar (Connec), the ad format affected the performance ratings (F(2, 45) = 3.84, p < .05). Planned contrasts showed that the average performance rating for the direct comparative format (MDC = 6.2) was higher than that for the noncomparative format (MNC = 5.2; F(1, 45) = 8.47, p < .01). When the advertised brand was relatively familiar (Philips), the ad format also affected the performance ratings (F(2, 44) = 3.37, p < .05). Planned contrasts showed that the average performance rating for the direct comparative format (MDC = 6.1) was lower than that for the noncomparative format (MNC = 7.1; F(1, 44) = 6.20, p < .01). These results provide further evidence in support of H6a.

For the confidence measure, there was an interaction (F(2, 89) = 3.70, p < .05) between the familiarity and the ad format manipulations. When the advertised brand was relatively unfamiliar (Connec), the ad format affected the confidence ratings (F(2, 45) = 8.05, p < .01). The average confidence rating in the direct comparative format (MDC = 5.8) was higher than the average confidence rating in the noncomparative format (MNC = 4.0; F(1, 45) = 14.59, p < .01), but when the advertised brand was relatively familiar (Philips), the ad format manipulation did not affect the confidence ratings.

For the average similarity rating, there was an interaction (F(2, 89) = 3.23, p < .01) between the ad format and the familiarity manipulations. Planned contrasts showed that when the advertised brand was relatively unfamiliar (Connec), the ad format manipulation affected the similarity ratings (F(2, 45) = 7.62, p < .01). Specifically, the average similarity rating for the direct comparative ad format (MDC = 4.0) was lower than that for the noncomparative format (MNC = 5.8; F(1, 45) = 12.46, p < .01). In contrast, when the advertised brand was relatively familiar (Philips), the ad format manipulation did not affect the similarity ratings. In addition, the two manipulations did not show an interaction for the attitude-toward-the-ad measure.

Finally, a multiple mediator analysis (MacKinnon 2000) on the performance ratings showed strong evidence that confidence acts as a mediating variable. In the presence of a standards war, the total effect of ad format on performance (B = .53, p < .01) was completely reduced in the multiple mediator model (B = .02, p > .10). More important, in keeping with H6a, there was a mediating effect (B = 2.77, p < .01) of confidence on the relationship between ad format and performance. No other mediating effect was significant.

Discussion

The results of Study 3 support our predictions. Across different measures, the relative familiarity of the advertised brand moderated the efficacy of comparative ad formats. The comparative ad format led to higher adoption rates, better performance ratings, more confident adoption decisions, and increased differentiation for the advertised brand when the advertised brand was relatively unfamiliar. In addition, the mediation analysis implicates the causal role of confidence ratings. These results are consistent with the explanation that the relative superiority of comparative formats is attributable to their uncertainty-reducing role. When we used the relatively unfamiliar brand (Connec) as the advertised brand, there was a high degree of uncertainty about the advertised brand’s performance in the standards war. As is reflected in the confidence measures, the direct comparative format best addressed this uncertainty. In contrast, when we used the relatively familiar brand (Philips) as the advertised brand, the uncertainty about the advertised brand was considerably lower. Consequently, the relative efficacy of the comparative ad format was diminished.

GENERAL DISCUSSION

In this research, we examine choice situations involving competing standards from a consumer’s perspective. We pay special attention to the impact of standards competition on a new product’s adoption rate, the value of performance-related product information to consumers, and the effectiveness of advertising formats. Building on prior research, we hypothesize that standards competition affects consumers’ likelihood of adopting a new product by altering the value they place on different types of performance-related product information and by affecting their responses to different advertising formats. Our results support these hypotheses. Specifically, our studies show the following:

• An ongoing standards competition has a negative effect on new product adoption.
• Information about the relative (absolute) performance of a product has a stronger (weaker) impact on the product’s share in markets with a standards war than in markets without a standards war.
• Standards competition affects consumer cognitions about advertisements and brands such that compared with their noncomparative counterparts, comparative ad formats (1) generate more confidence in the advertised brand and (2) do not create any negative affect or association heuristics, two commonly observed drawbacks of comparative advertisements.
• In the presence of standards competition, comparative advertisements outperform noncomparative advertisements in terms of new product adoption and perceived product performance.
• In the presence of a standards war, comparative ad formats are more (less) effective when the advertised brand is less (more) familiar than the comparison brand.

These results underscore the importance of understanding how standards competition affects consumer behavior and of developing appropriately effective marketing communication strategies. The finding that standards competition motivates consumers to emphasize (deemphasize) information that is comparative (noncomparative) in nature has strategic implications. Firms competing in such markets should emphasize relative product performance over absolute product performance in new product design and “go/no-go” decisions. In these markets, comparative ad formats may be far more attractive than previously realized.
because consumers behave differently under network effects and standards competition.

Limitations and Directions for Further Research

Several caveats pertaining to the current research should be noted. First, although in this research the uncertainty associated with a standards war is centered on the winner-takes-all nature of the market, note that not all standards wars lead to winner-takes-all outcomes. Second, we do not actively manipulate the cost of the competing technologies, a variable that may influence how standards competition affects consumer behavior. For example, our findings may not apply to scenarios in which the competing technologies are inexpensive and easily acquired by consumers. Third, our results may be more relevant for the earlier rather than for the later stages of a product’s life cycle because, in the later stages, the outcome of standards competition is less uncertain. Fourth, the use of video-phones as the only experimental product may be of concern. It is important to replicate the effects with other products.

Several important issues remain unexamined. First, it is puzzling to note that in Study 2, $H_1$ (i.e., a lower deferral rate in the absence of a standards war than in its presence) is supported under the noncomparative condition but not under the comparative conditions. This might be because the advantage of the comparative advertisement in markets with a standards war is so strong that it not only outperforms the noncomparative advertisement but also removes the negative impact of a standards war on product adoption. It is important to explore the underlying behavioral driver for this unexpected pattern. Second, an important issue in these markets is to identify factors that influence a consumer’s decision about when to adopt a new product, an issue that is perhaps best addressed by a longitudinal study. Third, a clearer understanding of consumer risk perceptions and the factors that influence expectations about the future installed base of a technological standard is needed. Finally, although our work focuses on standards competition, it may be possible that our findings are generalizable to other high-uncertainty scenarios. It is important to advance the understanding of the general relationship between uncertainty and the relative advantage of different types of product information in consumers’ new product adoption decisions.

REFERENCES


