

AMITAV CHAKRAVARTI and JINHONG XIE*

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

* Amitav Chakravarti is Assistant Professor of Marketing, New York University, 44 West Fourth Street, Suite 9-83, New York, NY 10012-1126 (Phone: 212 998 0517; Fax: 212 995 4006; email: achakrav@stern.nyu.edu). Jinhong Xie is Associate Professor of Marketing, University of Florida, P.O. Box 117155, Gainesville, FL 32611-7155 (Phone: 352 392 0161 Ext. 1233; Fax: 352 846 0457; email: jinhong.xie@cba.ufl.edu). The authors thank Bart Weitz, Joe Alba, Rich Lutz, and Alan Sawyer for their detailed comments and many helpful suggestions.

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ABSTRACT

In comparison 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 paper examines how standards competition affects consumer behavior, an issue that has been relatively neglected by past research in this area. Our results show that consumers behave very differently in the presence of a standards battle than in its absence: they depend on different types of information in their adoption decision and respond differently to advertising. Specifically, we find that standards competition motivates consumers to pay considerable more attention to information that is comparative in nature. Consequently, information regarding the relative (absolute) performance of a product has a stronger (weaker) impact on a product's share in markets with standards competition (Study 1). Consistent with this, standards competition also moderates the effectiveness of different advertising formats: it strengthens the effect of comparative ads, but weakens the effect of non comparative ads (Study 2). Interestingly, we find that due to this differential attention to comparative information, two commonly observed drawbacks of comparative ads - negative attitude towards ad and source confusion - disappear in the presence of standards competition (Study 2), and comparative ads even induce greater confidence in the advertised brand (Study 3). Finally, we find that in the presence of standards competition, the superiority of comparative ads is stronger when the advertised brand has a disadvantage than when it has an advantage in terms of brand familiarity (Study 3). This research takes a step towards a better understanding of these important, but under-explored, issues and provides managerial insights for firms launching new products in markets with competing standards.

INTRODUCTION

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 using 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 of achieving compatibility is so high that the entrant prefers to introduce its own technology.

Over the last two decades, we have observed 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, on-line music sharing software, recordable DVD, ultra wide band, 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 like 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 Dubé 2004), and intra-standard competition (Wang and Xie 2004).

While existing research has examined standard 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 may behave in markets with standards battles. Compared to other markets, those with standard battles exhibit certain fundamental characteristics that make the consumer's new product adoption decision more risky and complex. First, the expected utility of adopting a product 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 vs. Sega systems for video game players, DVD vs. Divx systems for digital video disk players, and Apple's iTunes vs. Microsoft's MSN Music for online music). Finally, adopting a "losing" standard can be very costly to consumers (e.g., to owners of the Betamax VCR and Divx digital video players). For these reasons, consumers may behave very 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 paper, 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) Since 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) Will the effectiveness of various advertising formats in markets with standards competition be moderated by consumer familiarity with the advertised and comparison brands?

To address these questions, we designed three studies. Study 1 was motivated by the fact that it is fairly commonplace to express consumption utility in both absolute and relative terms. Here 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 non comparative. Study 3 investigates the moderating effect of consumer brand familiarity on the effectiveness of advertising formats in markets with competing standards. The three studies are presented in the next three sections. After presenting the results of these three studies, we conclude by summarizing our findings, interpreting their implications, and discussing limitations and avenues for future research.

STUDY 1

Study 1 addresses two questions. 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 very strong impact on them, consumers have no means of predicting that outcome accurately. Consequently, consumers may defer making a choice and may even forego adopting a product altogether (e.g., see Tversky and Shafir 1992, Dhar 1997, Van den Bulte and Stremersch 2004). Thus, as a face validity check, we hypothesize that:

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 question addressed by Study 1 concerns the effect of standards competition on the importance that consumers place on different types of performance-related product information. Consumers often actively seek information about the performance of products they intend to buy in order 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 facing two alternative product offerings X and Y, a consumer 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. Clearly, 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 on both absolute and relative performance of a product, since it is predictive of the product's underlying absolute and relative utility.

We propose, however, 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 foregoing the other (Shafir and Tversky 1992, Inman, Dyer and Jia 1997). 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 feel very uncertain about which of the competing products will eventually win the battle. It is likely that consumers will resolve this uncertainty by carefully weighing the pros and cons of adopting one standard over another. Thus, information on 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 regarding 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 it is an unreliable predictor of the winning standard (Klopfenstein 1989), consumers are likely to give less weight to information regarding absolute product performance in markets with standards competition than in those without. Formally, we hypothesize that:

- H_{2a}: The impact of information regarding the *relative* performance of a product on consumers' adoption decisions is stronger in markets with standards competition than in those without.
- H_{2b}: The impact of information regarding the *absolute* performance of a product on consumers' adoption decisions is weaker in markets with standards competition than in those without.

Procedure and Stimuli

A total of 181 undergraduate subjects participated in a computer-based experiment with a 2 (presence/absence of standards wars) x 2 (high/low absolute ratings) x 2 (high/low relative ratings), between-subjects design. Videophones were chosen as the experimental product for two reasons: (a)

subjects did not have strong existing opinions about the product, and (b) subjects 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:

Step1. Subjects were briefed about the experimental session. The computer terminals randomly assigned the subjects to any one of the eight experimental conditions.

Step2. Subjects then read a description of a new product market (videophones). Depending on the condition assigned, subjects read either the “No Standards War” description or the “Standards War” description (see Figure 1, top panel). The first two paragraphs were identical for both descriptions and introduced the subjects to the new product, the key attributes of this product, and the two competing firms (Conmec and Dwyer) that produced it. The presence or absence of a standards war was manipulated by the third and fourth paragraphs in the description. Subjects assigned to the “Standards War” conditions were told 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 regarding the outcome of this battle. Subjects assigned to the “No Standards War” conditions were told 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 regarding the outcome of this battle. Thus, the key difference between the two descriptions was the presence or absence of compatibility between the brands.

Step3. After the subjects read the previous section to their satisfaction, they were given a choice task. Subjects saw one of the four possible choice scenarios (see Figure 1, middle panel). Subjects were told 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 (e.g., see Figure 1, bottom panel). The key manipulations involved varying Conmec’s absolute ratings (i.e., the star rating directly associated with Conmec) and relative ratings (i.e., the difference in the star ratings of Conmec and Dwyer).

For example, consider the condition where Conmec was rated 8 stars while Dwyer was rated 7 stars (see Figure 1, middle panel). Here Conmec's absolute and relative ratings were 8 stars and 1 star, respectively. The absolute rating of Conmec was varied at two levels, i.e., 8 stars or 10 stars. The relative rating of Conmec was also varied at two levels, i.e., a difference of 1 star or a difference of 3 stars. The design ensured that the absolute (relative) rating of Conmec was held constant when its relative (absolute) rating was varied. The focal brand, Conmec, was the higher-rated and more expensive brand (Conmec = \$120, Dwyer = \$80) in all four choice scenarios. In each case, subjects were given the option to defer their decision for a later occasion, choose the focal brand (Conmec), or choose the other brand (Dwyer). They were also asked to answer a manipulation check question.

Results

A binomial logistic regression model with effects coding was estimated to test all three hypotheses simultaneously. The estimated model was as follows:

$$P(\text{ADOPT}) = \Lambda(\hat{\beta}_0 + \hat{\beta}_1 * \text{SWAR} + \hat{\beta}_2 * \text{RELATIVE} + \hat{\beta}_3 * \text{ABSOLUTE} + \hat{\beta}_4 * \text{RELATIVE} * \text{SWAR} + \hat{\beta}_5 * \text{ABSOLUTE} * \text{SWAR} + \hat{\beta}_6 * \text{RELATIVE} * \text{ABSOLUTE} + \hat{\beta}_7 * \text{ABSOLUTE} * \text{RELATIVE} * \text{SWAR}),$$

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

Adoption Rates (H₁). Hypothesis H₁ suggests that standards competition dampens new product adoption, which is supported by the data ($\hat{\beta}_1 = -0.82$, standard error [S.E.] = 0.20, Wald- χ^2 (1, N = 181) =

16.27, $p < 0.01$). As shown in Table 1 (see second panel from top), the adoption rate was higher in the absence of a standards war (80%) than in its presence (51%).

Information on Relative Performance (H_{2a}). Hypothesis H_{2a} suggests that the presence of standards competition will strengthen the impact of information regarding relative performance. This prediction was supported by a significant interaction term ($\hat{\beta}_4 = 0.35$, S.E. = 0.20, Wald- $\chi^2(1, N = 181) = 2.94$, $p < 0.10$). This positive moderating effect is also apparent from the simple main effects. An increase in relative rating increases adoption rates in both cases: with standards war (parameter estimate [B] = 2.28, S.E. = 0.49, Wald- $\chi^2(1, N = 91) = 21.79$, $p < 0.01$), and without standards war (B = 1.17, S.E. = 0.57, Wald- $\chi^2(1, N = 90) = 4.17$, $p < 0.05$). However, this "increase" in new product adoption is greater in the presence of standards war (ADOPT_{low relative rating} = 24%, ADOPT_{high relative rating} = 76%, a 52% increase) than in the absence of standards war (ADOPT_{low relative rating} = 71%, ADOPT_{high relative rating} = 89%, an 18% increase), thus confirming H_{2a} (see the first graph in Table 1).

Information on Absolute Performance (H_{2b}). Hypothesis H_{2b} suggests that the presence of standards competition will weaken the impact of information regarding absolute performance. The interaction term, ABSOLUTE*SWAR, was not significant and H_{2b} is not supported ($\hat{\beta}_6 = -0.28$, S.E. = 0.20, Wald- $\chi^2(1, N = 181) = 1.84$, $p > 0.10$). However, the main effects are in the predicted direction even though the interaction term failed to achieve significance (see second graph in Table 2).

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 higher in the presence of a standards war than in its absence. This implies that standards competition strengthens the impact of information regarding relative product performance. On the other

hand, the fact that higher absolute ratings lead to an increase in new product adoption in the absence of standards competition but not so in the presence of such competition, provides some evidence of a negative moderating effect of standards competition on the impact of information regarding absolute performance. Furthermore, as a manipulation check, subjects were asked 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. Subjects reported greater use of relative judgments in the presence of a standards war (mean [M] = 5.7) than in its absence ($M = 5.0$, $F(1, 179) = 5.43$, $p < 0.05$). The manipulation check further confirms our claims.

STUDY 2

Although Study 1 clearly demonstrated the importance of information on 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 communication that conveys information on the relative performance of a target brand. One way of conveying information about the relative performance of a product is to use ad formats that are comparative in nature. Would the increased value of information on relative performance lead to a greater preference for comparative over non comparative ad formats? More specifically, in the presence of standards competition, are comparative formats more effective than non comparative formats in inducing consumers to adopt the advertised brand? We address this research question in the current study.

While the consumer's adoption decision is a key variable of interest, it is also important to know how the ad format affects consumer cognitions concerning the ad and the brand (e.g., attitude towards ad, differentiation). Based on data from Study 1 and past 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, i.e., does the presence of a standards war alter the

effect of the ad format on consumer cognitions? This is important because past research on comparative advertising neither manipulated the presence of standards competition, nor the concomitant uncertainty.

The first variable of interest is *confidence* in the advertised brand. Past research suggests that comparative ads 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 on 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 on relative product performance creates greater confidence in the target brand. Since comparative ad formats tend to provide information about relative performance of the advertised product, whereas non comparative ad formats typically do not, it is likely that there will be greater confidence in the advertised brand when the format is comparative than when it is non comparative. Thus, we hypothesize that the presence of a standards war will positively moderate the effect of comparative ads on confidence in the advertised brand.

The second variable examined is *attitude towards the ad*. Past research has shown that comparative formats can be less effective than non comparative formats due to the generation of negative affect since consumers often find such ads offensive and irritating (e.g., see Pechmann & Ratneshwar 1991). Negative affect or ad-evoked feelings, in turn, often lead to source derogation, discounting of ad message, and negative attitude toward the ad and advertised brand (Brown, Homer and Inman 1998). As a result, consumers may view the advertised brand unfavorably (Batra and Ray 1986). In contrast, non comparative ads do not generate negative affect because they avoid comparison between brands (Grewal et al. 1997). We expect the presence of a standards war to moderate this effect. We conjecture that comparative ads will not generate negative affect in the presence of a standards war, because (a) consumers actively look for information on relative product performance (e.g., see Study 1), and (b) comparative ad formats provide information on relative product performance. Thus we hypothesize that the

"informational" aspect of the comparative ad (i.e., information on relative product performance) will shift attention away from its "affective" aspect (i.e., an offensive tone).

The third variable of interest is *association heuristics*. Past 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 the consumer's belief 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, then they must be similar. By avoiding any comparison, non comparative ads do not invoke this heuristic. Several studies (e.g., Pechmann and Ratneshwar 1991, Gorn and Weinberg 1984, and Grewal et al. 1997) document this unintended associational effect of comparative advertising. We hypothesize that the presence of a standards war will suppress such heuristic processing associated with comparative ads. Our hypothesis is predicated on the fact that subjects' motivational states have a strong influence on the use of heuristics. Past 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 subjects exposed to a standards war were strongly motivated to look for a particular type of information (i.e., information on relative performance). We therefore expect diminished use of association heuristics in the presence of a standards war.

Finally, we address the key question of how comparative ad formats affect adoption of the advertised brand. Based on the results of Study 1 and our discussion about the impact of standards competition on cognitive and affective variables, we expect that the presence of a standards war will have 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:

- H₃:** The presence of standards competition moderates the effect of ad format on cognitive and affective variables. Specifically, moving from non-comparative to comparative ads is more likely to (a) increase confidence, (b) reduce negative affect, and (c) suppress association heuristics, in the presence of standards competition than in its absence.
- H₄:** The presence of standards competition moderates the effect of ad format on consumers' adoption decisions. Specifically, moving from non-comparative to comparative ads 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.

Design, Stimuli, and Procedure

We again used videophones as the experimental product in a 2 (presence/absence of standards war) x 3 (ad formats), between-subjects design. A total of 95 subjects were given extra credit in an undergraduate marketing course for participation in this computer-based study. The three types of ad formats were *direct comparative*, *indirect comparative*, and *non comparative*. The first two steps were identical to that of Study 1, so the remaining steps are listed below:

Step3. In this step, subjects saw an ad for the Conmec brand on the computer screen. Each subject saw an ad that was one of three formats listed earlier. Each brand was described by three product-based attributes (clarity of picture, quality of video, power consumption) and three non product-based attributes (industry support, availability at retail outlets, sales). Figure 2 presents the direct comparative ad along with the ad copy of the other two formats. After reviewing the ad, subjects continued to the next step.

Step4. In this step, subjects were first asked to provide similarity ratings. Specifically, they were asked to indicate how similar they thought the advertised brand, Conmec, was to its competitor, Dwyer, with respect to each of the six attributes discussed in the ad. Each response was recorded on a 9-point scale with "most different" and "exact same" as the endpoints. Subjects were then asked to rate Conmec's perceived performance in comparison to Dwyer on each of the six target attributes on 9-point scales.

Subjects were then given a choice task in which they were presented with two offers: (a) the advertised brand (Conmec) at a price of \$490, and (b) the non advertised brand (Dwyer) at a price of \$380.

Subjects were asked to: (a) choose the advertised brand, or (b) choose the non advertised brand, or (c) defer their decision. We then measured each subject's attitude toward the ad and confidence in the advertised brand. Finally we asked subjects to rate the importance of each of the six videophone attributes.

Results

Table 2 presents the results of Study 2. We discuss our key findings by focusing on the comparisons of direct comparative and non comparative formats. Other comparisons can be inferred from Table 2. For all other detailed statistical results, the readers are referred to Chakravarti and Xie (2005). We will now examine how our manipulations affected each of the variables discussed earlier. Also, hereafter we use sw and \overline{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 ($F(2, 89) = 3.45, p < 0.05$). The confidence measures were unaffected by the ad format under \overline{sw} . However, they were affected by the ad format under sw ($F(2,45)=6.00, p<0.01$). In the presence of standards competition, the direct comparative format created more confidence in the advertised brand than did the non comparative format ($M_{DC} = 5.3, M_{NC} = 3.4, F(1, 45) = 11.02, p < 0.01$). This result confirms H_{3a} .

Attitude Towards The Ad. The standards war manipulation also interacted with the ad format manipulation for the attitude towards ad ratings ($F(2, 89) = 3.65, p < 0.05$). Compared to the non comparative format, the direct comparative format worsened the attitude towards the ad under \overline{sw} ($M_{NC} = 6.9, M_{DC} = 4.8, F(2, 44) = 13.28, p < 0.01$), but did not generate any negative affect under sw ($F(2, 45) = 0.04, p > 0.10$). Hence, H_{3b} is also supported.

Similarity. The standards war manipulation also interacted with the ad format manipulation for the similarity ratings ($F(2, 89) = 13.40, p < 0.01$). In comparison with the non comparative format, the direct comparative format provided less differentiation (i.e., higher similarity ratings) under \overline{sw} ($M_{NC} = 4.8, M_{DC} =$

5.9, $F(2, 44) = 7.10, p < 0.01$), but more differentiation (i.e., lower similarity ratings) under \overline{sw} ($M_{NC} = 6.8, M_{DC} = 4.7, F(1, 45) = 19.89, p < 0.01$). These results are consistent with H_{3c} .

Choice Share. The standards war manipulation also interacted with the ad format manipulation for the focal brand choice shares ($B=1.77, S.E.=0.55, Wald-\chi^2(1,N=95)=10.09, p<0.01$). While the ad format manipulation affected choice shares both with and without standards competition, these effects had opposite directions. Under \overline{sw} , the choice share of the advertised brand is the lowest (31%) when the ad format is direct comparative (DC) and the highest (63%) when the ad format is non comparative (NC). Under sw , the opposite is true, and the choice share is the highest (69%) when the ad format is DC and the lowest (19%) when the ad format is NC. The disadvantage of the direct comparative ad format under \overline{sw} ($B= -0.65, S.E.= 0.37, Wald-\chi^2(1, N=47)=3.04, p<0.10$) and the advantage of the directive comparative ad format under sw ($B=1.12, S.E.=0.41, Wald-\chi^2(1, N=32)=7.25, p<0.01$) support H_{4a} .

Performance. Finally, the standards war manipulation interacted with the ad format manipulation for performance ratings ($F(2, 89)=23.04, p<0.01$). The performance measure presents a similar pattern as the choice share measure. The non comparative ad format led to higher performance ratings under \overline{sw} ($M_{NC} = 6.7, M_{DC} = 4.9, F(2, 44) = 8.30, p < 0.01$), but the reverse is true under sw ($M_{NC} = 4.6, M_{DC} = 6.8, F(1, 45) = 34.09, p < 0.01$). Hence, H_{4b} 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 towards ad mediates the influence of ad format on performance ($B = -1.74, p < 0.05$). In the presence of a standards war, similarity ratings have a more modest mediating effect on the influence of ad format on performance ($B = 1.35, p < 0.10$). In summary, we find support for a mediating role of attitude towards ad in the absence of standards war, and a mediating role of similarity ratings in the presence of standards war.

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 non comparative 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 impact 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 the non comparative format. In the absence of a standards war, the non comparative format induces better adoption rates and performance ratings than the 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 relatively more effective because of the superior differentiation they provide. In contrast, in the absence of a standards war, comparative ad formats are relatively less effective because of the negative affect they generate.

STUDY 3

In Study 2, we argued that comparative ads are more effective in a market with standards wars because they reduce *prior uncertainty about the advertised brand* by providing information on the product's relative performance. In other words, it appears that consumers use the information in an ad 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 regarding the advertised brand's relative performance and its ability to win the standards war, then manipulating these priors should allow us to test this process explanation.

Since consumers often use brand names to predict the performance of new products (Janiszewski and Van Osselaer 2000), one way of manipulating these priors is to vary the familiarity of the advertised brand relative to the comparison brand. Consider, for example, a market where a standards battle is being fought between a familiar, well-known brand and an unfamiliar brand. In such a market, *ceteris paribus*, consumers are likely to believe that a well-known brand has a greater chance of winning the standards competition than the unknown brand. Further, 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 while the comparison brand is the well-known one. If our process explanation regarding the uncertainty-reducing role of a comparative ad holds true, then the comparative ad format is likely to have much less impact in the former situation than in the latter. Since uncertainty regarding the advertised brand's ability to win the standards battle is much higher in the second situation than in the first, it is likely that the comparative ads will have a much greater impact in the latter situation than in the former. Put differently, when the advertised brand is familiar (and the comparison brand is unfamiliar), the information in the comparative ad is in line with the priors and is therefore likely to have a much weaker effect than when the advertised brand is unfamiliar (and the comparison brand is familiar), where the information in the comparative ad updates the priors by providing different information from that previously held.

However, if our process explanation does not hold, then the effectiveness of comparative ad formats should not vary as a function of this prior uncertainty. In fact, a different pattern of results could very well emerge. For example, it is possible that subjects 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 inconsistent with our process explanation and contrary to our hypothesis. Unlike in Study 2, in this study we varied the familiarity of the two brands to verify the uncertainty-reducing

role of comparative ad formats. Formally, we hypothesize:

- H₅:** In the presence of standards competition, (a) the benefit of moving from a non comparative to a comparative ad format is higher if the advertised brand has a disadvantage than if the advertised brand has an advantage in terms of familiarity relative to the comparison brand, and (b) the relative superiority of the comparative formats over the non comparative formats is mediated by the confidence in the advertised brand.

Stimuli, Design, and Procedure

We tested our proposition in a 2 (familiarity of advertised vs. comparison brand) x 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 were given extra credit for participating in the study. Once again, the product was videophones. Subjects were randomly assigned to one of the six experimental conditions. The first and second steps were identical to those of Study 2, except for the fact that the brand names used were Philips and Conmec. In the third step they saw an ad 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 ads were in one of three formats: direct comparative, indirect comparative, or non comparative. After the subjects reviewed the ads, they went on to 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 and readers are referred to Chakravarti and Xie (2005) for more details. As hypothesized, the relative familiarity of the advertised brand moderated the efficacy of the comparative formats ($B = -1.09$, $S.E. = 0.60$, $Wald-\chi^2(1, N = 95) = 3.31$, $p < 0.10$). When the advertised brand was unfamiliar (Conmec) and the comparison brand was familiar (Philips), the proportion of subjects choosing the advertised brand

in the direct comparative format was higher than the corresponding proportion in the non comparative format (DC = 44%, NC = 6%, $B = 1.22$, S.E. = 0.57, Wald- $\chi^2(1, N = 32) = 4.57$, $p < 0.05$). When the advertised brand was familiar (Philips) and the comparison brand was unfamiliar (Conmec), the choice share of the advertised brand did not differ across the ad formats. This supports H_{5a} .

For performance ratings, there was also an interaction between the ad format and familiarity manipulations ($F(2, 89) = 7.08$, $p < 0.01$). In the condition where the advertised brand was relatively unfamiliar (Conmec), the ad format affected the performance ratings ($F(2, 45) = 3.84$, $p < 0.05$). Planned contrasts showed that the average performance rating for the direct comparative format ($M_{DC} = 6.2$) was higher than that of the non comparative format ($M_{NC} = 5.2$, $F(1, 45) = 8.47$, $p < 0.01$). When the advertised brand was relatively familiar (Philips), the ad format also affected the performance ratings ($F(2, 44) = 3.37$, $p < 0.05$). Planned contrasts showed that the average performance rating for the direct comparative format ($M_{DC} = 6.1$) was lower than that of the non comparative format ($M_{NC} = 7.1$, $F(1, 44) = 6.20$, $p < 0.01$). These results provide further evidence confirming H_{5a} .

For the confidence measure there was an interaction ($F(2, 89) = 3.70$, $p < 0.05$) between the familiarity and ad format manipulations. When the advertised brand was relatively unfamiliar (Conmec), the ad format had an impact on the confidence ratings ($F(2, 45) = 8.05$, $p < 0.01$). The average confidence rating in the direct comparative format ($M_{DC} = 5.8$) was higher than the average confidence rating in the non comparative format ($M_{NC} = 4.0$, $F(1, 45) = 14.59$, $p < 0.01$). 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 ($F(2, 89) = 3.23$, $p < 0.01$) between the ad format and familiarity manipulations. Planned contrasts showed that when the advertised brand was relatively unfamiliar (Conmec), the ad format manipulation affected the similarity ratings ($F(2, 45) = 7.62$, $p < 0.01$). Specifically, the average similarity rating for the direct comparative ad format ($M_{DC} = 4.0$) was lower

than that of the non comparative format ($M_{NC} = 5.8$, $F(1, 45) = 12.46$, $p < 0.01$). In contrast, when the advertised brand was relatively familiar (Philips), the ad format manipulation did not affect the similarity ratings. Additionally, the two manipulations did not show an interaction for the attitude toward 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 ($B=0.53$, $p<0.01$) was completely reduced in the multiple mediator model ($B = 0.02$, $p>0.10$). More importantly, in keeping with our hypothesis (H_{5b}) there was a mediating effect ($B = 2.77$, $p<0.01$) 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 efficacy of comparative ad formats was moderated by the relative familiarity of the advertised brand. 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. Additionally, 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 (Conmec) as the advertised brand, there was a high degree of uncertainty regarding the advertised brand's performance in the standards war. As reflected in the confidence measures, this uncertainty was best addressed by the direct comparative format. In contrast, when we used the relatively familiar brand (Philips) as the advertised brand, the uncertainty regarding 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 upon past research, we hypothesize that standards competition affects a consumer's likelihood of adopting a new product by altering the value that consumers place on different types of performance-related product information, and by affecting consumers' responses to different advertising formats. Our results support these hypotheses. Specifically, our studies show that:

- An ongoing standards competition has a negative effect on new product adoption.
- Information regarding 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 ads and brands such that compared to their non comparative counterparts, comparative ad formats (a) generate more confidence in the advertised brand, and (b) do not create any negative affect or association heuristics, two commonly observed drawbacks of using comparative ads.
- In the presence of standards competition, comparative ads outperform non comparative ads 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.

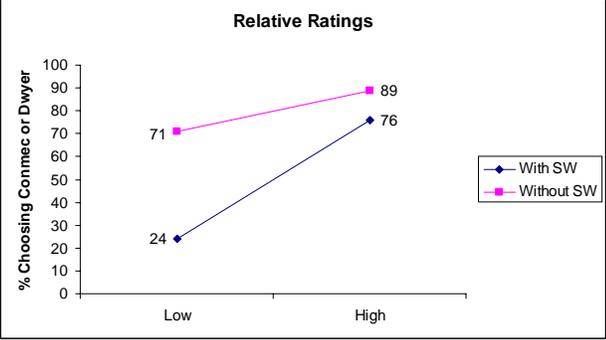
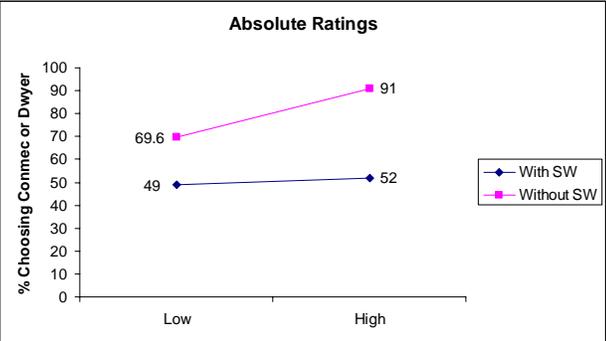
These results underscore the importance of understanding how standards competition affects consumer behavior and developing appropriately effective marketing communication strategies. The finding that standards competition motivates consumers to emphasize (deemphasize) information that is comparative (non comparative) 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 Future Research

Several caveats concerning the current research should be highlighted. First, although in this research the uncertainty associated with a standards war is centered on the “winner-takes-all” nature of the market, it is important to 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 affect how standards competition impacts consumer behavior. For example, our findings may not apply to scenarios where the competing technologies are inexpensive and easily acquired by consumers. Third, our results may be more relevant for the earlier rather than 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 videophones 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 a little puzzling to note that in Study 2, H1 (i.e., a lower deferral rate in the absence of a standards war than in its presence) is supported only under the non comparative condition but not under the comparative conditions. This might be because the advantage of the comparative ad in markets with a standards war is so strong that it not only outperforms the non comparative ad 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 regarding when to adopt a new product, a question that is perhaps best addressed by a longitudinal study. Third, we also need a clearer understanding of consumer risk perceptions and factors that influence expectations about the future installed base of a technological standard. Finally, while 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 our understanding of the general relationship between uncertainty and the relative advantage of different types of product information in the consumer’s new product adoption decision.

TABLE 1: STUDY 1 RESULTS

		Without Standards War		With Standards War										
Count (%) for each Choice Option		Absolute Rating		Absolute Rating										
		Low	High	Low	High									
Relative Rating	Low	N = 23 { Conmec: 9 (39%) { Dwyer: 3 (13%) { Defer: 11 (48%)	N = 22 { Conmec: 15 (68%) { Dwyer: 5 (23%) { Defer: 2 (9%)	N = 22 { Conmec: 4 (18%) { Dwyer: 1 (5%) { Defer: 17 (77%)	N = 23 { Conmec: 5 (22%) { Dwyer: 1 (4%) { Defer: 17 (74%)									
	High	N = 23 { Conmec: 15 (65%) { Dwyer: 5 (22%) { Defer: 3 (13%)	N = 22 { Conmec: 16 (73%) { Dwyer: 4 (18%) { Defer: 2 (9%)	N = 23 { Conmec: 13 (57%) { Dwyer: 4 (17%) { Defer: 6 (26%)	N = 23 { Conmec: 14 (61%) { Dwyer: 4 (17%) { Defer: 5 (22%)									
H1: Impact of Standards Competition on Category Adoption		Category Adoption: { Without Standards War 72 (80%) { With Standards War 46 (51%)												
H2a: Impact of Relative Performance On Category Adoption (NB: SW = Standards War)		 <table border="1"> <caption>Relative Ratings Data</caption> <thead> <tr> <th>Rating</th> <th>With SW</th> <th>Without SW</th> </tr> </thead> <tbody> <tr> <td>Low</td> <td>24</td> <td>71</td> </tr> <tr> <td>High</td> <td>76</td> <td>89</td> </tr> </tbody> </table>				Rating	With SW	Without SW	Low	24	71	High	76	89
Rating	With SW	Without SW												
Low	24	71												
High	76	89												
H2b: Impact of Absolute Performance On Category Adoption (NB: SW = Standards War)		 <table border="1"> <caption>Absolute Ratings Data</caption> <thead> <tr> <th>Rating</th> <th>With SW</th> <th>Without SW</th> </tr> </thead> <tbody> <tr> <td>Low</td> <td>49</td> <td>69.6</td> </tr> <tr> <td>High</td> <td>52</td> <td>91</td> </tr> </tbody> </table>				Rating	With SW	Without SW	Low	49	69.6	High	52	91
Rating	With SW	Without SW												
Low	49	69.6												
High	52	91												

Note: The figures in parenthesis represent choice shares.

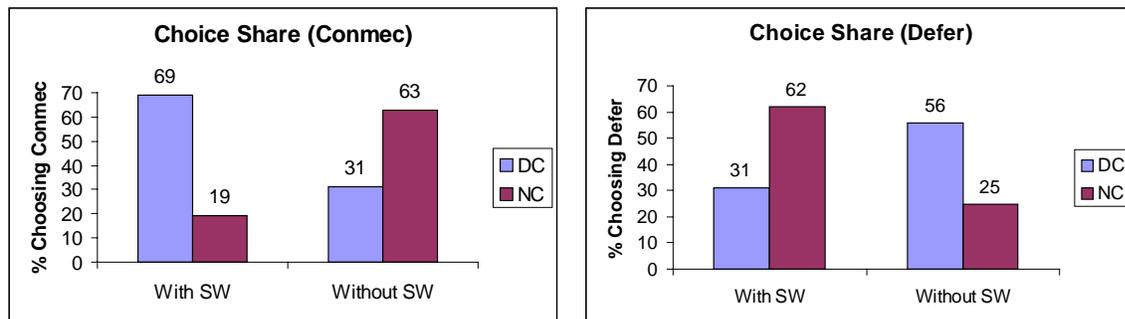
TABLE 2: STUDY 2 RESULTS

Ad Formats	With Standard Wars			Without Standard Wars		
	Direct Comparative (N = 16)	Indirect Comparative (N = 16)	Non-comparative (N = 16)	Direct Comparative (N = 16)	Indirect Comparative (N = 15)	Non-comparative (N = 16)
Choice Shares						
Defer Choice	31%	50%	62% ^{a*}	56%	53%	25% ^{a*}
Advertised Brand	69%	44%	19% ^a	31%	40%	63% ^{a*}
Confidence Measures	5.3	4.6	3.4 ^{a, b}	4.5	4.5	4.7
Attitude towards Ad	5.9	6.1	6.1	4.8	5.9 ^a	6.9 ^{a, b}
Similarity Ratings	4.7	5.6 ^{a*}	6.8 ^{a, b}	5.9	4.4 ^{a*}	4.8 ^a
Performance Ratings	6.8	6.0 ^a	4.6 ^{a, b}	4.9	6.0 ^a	6.7 ^{a, b}

^a cell means differ from direct comparative means ($p < 0.05$)

^{a*} cell means differ from direct comparative means ($p < 0.10$)

^b cell means differ from indirect comparative means ($p < 0.05$)



(NB: SW = Standards War; NC = Non Comparative; DC = Direct Comparative)

TABLE 3
RESULTS OF STUDY 3: MEANS

Ad Formats	Ad Brand (Connec) Is Less Familiar (<i>High</i> Prior Uncertainty)			Ad Brand (Philips) Is More Familiar (<i>Low</i> Prior Uncertainty)		
	Direct Comparative (N = 16)	Indirect Comparative (N = 16)	Non- Comparative (N = 16)	Direct Comparative (N = 16)	Indirect Comparative (N = 16)	Non- Comparative (N = 15)
Choice Shares						
Defer Choice	50%	44%	38%	56%	56%	60%
Advertised Brand	44%	31%	6% ^{a, b*}	31%	31%	33%
Confidence Measures	5.8	4.9 ^a	4.0 ^{a, b*}	5.7	5.8	5.9
Attitude towards Ad	6.1	5.9	5.4	6.4	6.1	5.7
Similarity Ratings	4.0	5.0 ^a	5.8 ^{a, b*}	5.0	5.0	5.2
Performance Ratings	6.2	5.8	5.2 ^a	6.1	6.7	7.1 ^a

^a cell means differ from direct comparative means ($p < 0.05$)

^{b*} cell means differ from indirect comparative means ($p < 0.10$)

FIGURE 1

STUDY 1 MANIPULATION, CHOICE SCENARIOS, AND CHOICE SCENARIO EXAMPLE

Manipulation:

NO STANDARDS WAR DESCRIPTION

The New Videophone Industry

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.

STANDARDS WAR DESCRIPTION

The New Videophone Industry

Due to a very recent technological breakthrough in sending voice and video over a POTS (plain old telephone system) line, a consumer market for video telephones is now emerging. 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 incompatible with each other. Users of the Conmec brand of videophone will not be able to communicate with the users of the Dwyer videophone, and vice versa. Software functions such as message recording and image editing for Conmec systems will not work with messages and images from Dwyer systems.

Analysts predict a winner-take-all, VCR-like standards battle. As of now there is a lot of uncertainty about which brand will eventually emerge as the winner.

Choice Scenarios:

Standards War Absent

Low Absolute Rating

High Absolute Rating

Standards War Present

Low Absolute Rating

High Absolute Rating

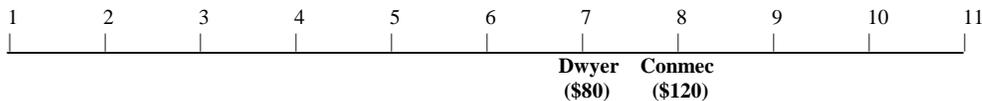
Low Relative Rating
High Relative Rating

Dwyer = 7, Conmec = 8	Dwyer = 9, Conmec = 10	Dwyer = 7, Conmec = 8	Dwyer = 9, Conmec = 10
Dwyer = 5, Conmec = 8	Dwyer = 7, Conmec = 10	Dwyer = 5, Conmec = 8	Dwyer = 7, Conmec = 10

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:



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.

FIGURE 2

STUDY 2 AD STIMULUS: DIRECT, INDIRECT, AND NON COMPARATIVE FORMATS

Direct Comparative Format

The new CONMEC Videophone !

Here's what's really different about the Conmec Videophone:

Crystal Clear

- With 500 lines of horizontal resolution (HR), Conmec offers you pictures that are twice as clear as the Dwyer videophone.

Real Time Video

- A communication speed of 56 kilo bytes per second (Kbps), or 40-45 frames per second (fps), that is far superior to Dwyer, gives you a smooth, no-jerk, video signal. Just like on TV.

Electricity Bills

- And all this, without any monster electricity bills. Conmec consumes half as much power as Dwyer does.

Great Support

- More videophone manufacturers, software developers, & technicians to look after your every need, than competitors like Dwyer.

Available Everywhere

- Your Conmec Videophone is now available at more stores and shops than the Dwyer videophone.

Preferred

- Already we have sold a 100,000 units, much more than competitors like Dwyer.



Choose CONMEC: The Best Way To Keep in Touch !

Ad Copy* for the Indirect Comparative Format

- Crystal Clear**
- With 500 lines of horizontal resolution (HR), **Conmec** offers you pictures that are twice as clear as any other videophone.
- Real Time Video**
- A communication speed of 56 kilobytes per second (Kbps), or 40-45 frames per second (fps), that is far superior to all other brands, gives you a smooth, no-jerk, video signal. Just like on TV.
- Electricity Bills**
- And all this, without any monster electricity bills. **Conmec** consumes half as much power as any other brand does.
- Great Support**
- More videophone manufacturers, software developers, & technicians to look after your every need, than any other competitor.
- Available Everywhere**
- Your **Conmec** Videophone is now available at more stores and shops than any other videophone.
- Preferred**
- Already we have sold a 100,000 units, much more than any other competitor.

Ad Copy* for the Non Comparative Format

- Crystal Clear**
- With 500 lines of horizontal resolution (HR), **Conmec** offers you pictures that are crystal clear.
- Real Time Video**
- A communication speed of 56 kilobytes per second (Kbps), or 40-45 frames per second (fps), gives you a smooth, no-jerk, video signal. Just like on TV.
- Electricity Bills**
- And all this, without any monster electricity bills. **Conmec** consumes very little power.
- Great Support**
- Videophone manufacturers, software developers, & technicians to look after your every need.
- Available Everywhere**
- Your **Conmec** Videophone is now available at a lot of stores and shops.
- Preferred**
- Already we have sold a 100,000 units.

* NB: Barring the copy differences, the ad (picture/layout) was identical to the direct comparative ad shown above.

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