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Communicating technological innovations

The role of technical complexity and product involvement

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Abstract

Purpose – Consumers' perceptions of new technologies are vital for the adoption of innovations. However, due to the complexity of technological innovations and associated consumer concerns, marketing communications play a crucial role in shaping attitudes. In this context, the level of technical complexity presented in advertisements can be a critical determinant of communication effectiveness. The paper aims to discuss this issue.

Design/methodology/approach – By conducting an experiment in the context of plug-in hybrid electric cars, this study examines the impact of technical complexity on communication effectiveness. The authors also include consumers' product involvement as a potential moderator of this relationship.

Findings – This paper reveals that individuals with low product involvement respond more favourably to technically simple ads. However, medium-involved consumers show the best responses towards ads with a high level of technical complexity. Interestingly, the authors could not find significant attitude differences for high-involvement individuals in terms of the level of technical complexity.

Practical implications – The results support the notion that the advice "keep it short and simple" is not always appropriate. In particular, when marketers want to communicate technological innovations, a more complex presentation can provoke positive reactions, when the audience has at least a medium level of product involvement.

Originality/value – There is little evidence concerning how technical complexity within marketing communications affects consumer attitudes. This study significantly contributes to the understanding of how advertisements of technological innovations are perceived by consumers.

Keywords Experiment, Product involvement, High-tech marketing, Innovation marketing, Technical complexity, Technological innovations

Paper type Research paper

Introduction

High-tech environments are generally characterised by an inherent dynamism, a fast technological pace and increasingly short product life cycles (Beard and Easingwood, 1996; Lynn *et al.*, 1999; Su *et al.*, 2013). Under these demanding market conditions, marketing communication efforts are vital to adequately support customers' decision processes (Narayanan and Manchanda, 2009). Communication success is, however, difficult to anticipate because technological innovations are often complex in nature and incorporate new or unknown technologies that entail a considerable degree of uncertainty for producers and consumers alike (Murmann and Frenken, 2006; Sicotte and Bourgault, 2008). The uncertainty can, for example, stem from the market side, meaning that companies are not able to predict future market success of new technologies because they cannot anticipate the rate of diffusion. Another form of uncertainty can stem from the technological side, underlining customers' inability to evaluate the performance of a never before used or tested technology (Moriarty and Kosnik, 1989). Moreover, the lack of prior experiences can have a negative impact on product familiarity and product expertise (Alba and Hutchinson, 1987), which makes it difficult for companies to convince potential customers of the benefits of new technological innovations.

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Naturally, advanced technological features offer customers a better or more efficient way to fulfil their needs. However, products that are targeted at the mass market face the challenge of persuading an audience that is generally characterised by risk aversion and the demand for proven concepts (Rogers, 2003). The question arises as to how companies should inform consumers about products' advanced technological features. The problem is that "with all of this technology, however, comes jargon" (Bradley and Meeds, 2004, p. 291). One major challenge for marketers is therefore to choose the "right" information regarding complex high-tech products, allowing customers to grasp relevant product benefits and functionalities while reducing cognitive risks (Chen *et al.*, 2007; Yadav *et al.*, 2006). Yet, the persuasive impact of communication content largely depends on the message receiver's ability to process presented information (Perloff, 2003). Recognising the fact that the mental processing capacity is limited and that consumers' attention is selective (MacInnis and Jaworski, 1989) leads to the conclusion that marketers need to carefully choose their communication strategy for products that, by nature, are more complex and therefore more difficult to understand for consumers (Slater and Mohr, 2006).

One way to capture consumers' attention and to influence attitudes towards high-tech advertisements is to vary the degree of built-in complexity. Across different dimensions of advertising complexity (e.g. visual complexity, lexical complexity, information complexity), technical complexity is especially important when communicating high-technology products. The complex nature of high-tech products makes it particularly difficult to translate product benefits and technological features into a persuasive message design. Although studies exist which particularly focus on how to manage marketing communication activities in high-technology environments (e.g. Baccarella *et al.*, 2014, 2016; Scheiner *et al.*, 2015), there has been little research on the role of technical complexity in high-tech advertisements and how it influences viewers' attitudes. Up to now, there has been little understanding about the persuasive impact of technical wording in advertisements of technologically complex products. Our paper therefore examines the influence of technical complexity on advertising effectiveness of high-technology advertisements, considering consumers' product involvement as a moderator of this effect. In this respect, this study contributes to the innovation and the marketing literature, helping to further explain the often overlooked communication mechanisms in the context of technological innovations.

In the next section, we propose hypotheses based on the extant literature dealing with technical complexity, its influence on message effectiveness, and the moderating role of involvement. Afterwards, we present the experimental study and report our results. Finally, the paper concludes with important implications, limitations and possibilities for further research.

Literature review and development of hypotheses

Technical complexity

Studies have revealed mixed results regarding the degree and nature of complexity that should be embedded in advertisements. One stream of research proposes to completely diminish complexity in advertising and suggests marketers keep it as simple as possible (e.g. Zinkhan and Martin, 1983). Authors supporting this view argue that simplicity in advertisements increases the probability of consumers paying more attention to them because they do not get bored. They also state that simple advertisements require less cognitive effort to process the message content presented (Pieters *et al.*, 2010; Putrevu *et al.*, 2004). Yet, the advice "keep it simple" and the resultant endless attempt to strive for simplicity in advertisements might not always be the best way to design effective communication content (Macklin *et al.*, 1985). Studies that support this notion have revealed that complex advertisements are superior because the built-in complexity captures viewers' attention and enhances their motivation to deal with advertising content

(Bruner and Kumar, 2000; Chamblee *et al.*, 1993; Phillips, 1997). A key challenge that marketers face is therefore to select the right amount of advertising complexity to preserve the persuasive power of their messages in order to achieve the best "mental fit" and to ultimately convince potential customers.

High-technology products by definition possess new product features and/or unknown technologies that are difficult to communicate to a broad audience (for a review, see Wagner, 2017). Marketers face the challenge of incorporating and "translating" technical features into the overall context of their advertisements. Technical wording, and therefore technical complexity, in advertisements can thus be an important set screw when approaching potential customers (Teng *et al.*, 2010). Excessive use of technical language, however, confronts consumers with an increased level of technical complexity. If consumers do not possess a certain amount of prior product knowledge, too much information and therefore increased complexity could lead to confusion and ultimately to the rejection of innovative technology products (Lee and O'Connor, 2003).

Generally, technical complexity in the context of marketing communication refers to the "technical content and jargon used in a particular advertisement" (Putrevu *et al.*, 2004, p. 9). It has been previously shown that the application of technical language in advertisements can lead to favourable results. In an early work on technical complexity, Anderson and Jolson (1980) suggest that a higher level of technical complexity can have a positive effect on overall product evaluation. This is, however, only true for consumers with considerable product experience. Another study by Holbrook (1978) proposes that messages that contain more factual than subjective elements are superior in creating favourable brand attitudes. Bradley and Meeds (2004) come to a similar conclusion and find that if technical language is comprehensible, it can have a positive effect on overall product perception. At the same time however, an overuse of technical language was found to have a negative effect on the understandability of messages (Joiner *et al.*, 2002). Similarly, Lautman and Percy (1978) argue that consumers who do not possess any product knowledge have difficulty in understanding technical wording or terms, and can perceive marketers' use of complex language to be incompatible with their own needs.

Product involvement

The above-mentioned arguments indicate that the optimal degree of technical complexity in advertising varies according to differences in the consumers' characteristics. Moore and Benbasat (1991) argue that individuals with different levels of prior accumulated experiences can differ in their perception of certain innovative characteristics. In this context, studies have argued that involvement is generally an important factor when analysing message effectiveness in the context of technical complexity (Alba and Hutchinson, 1987). Especially in the context of high-tech advertising, involvement is an essential factor in attempting to explain communication effects (Lee and O'Connor, 2003).

A widely used definition describes involvement as "a person's perceived relevance of the object based on inherent needs, values, and interests" (Zaichkowsky, 1985, p. 342). This implies that messages differ in their impact on consumers depending upon how relevant the content will be perceived. According to the elaboration likelihood model (ELM) (Cacioppo and Petty, 1984; Petty and Cacioppo, 1986), involvement is a critical factor influencing persuasive outcomes of message recipients. The authors argue that the higher the relevance of a message for receivers, for example, because individuals are familiar with the topic and possess prior subject-related knowledge, the more likely it is that those individuals will more easily process fact-related message content. The ELM argues that consumers with high motivation or involvement will take the central route of persuasion, which means that issue- or product-relevant arguments are more suited to convincing them.

In contrast, if consumers do not have the ability or do not want to actively think about issue-related content, peripheral message cues might be more effective.

It can thus be expected that messages containing a variety of product-related features and which thus contain a higher level of technical complexity will be more effective in conditions of high product involvement. Similarly, Johnson and Russo (1984) argue that experienced consumers will find it easier to select and process relevant product information, thereby implying that they can better cope with existing technical complexity. This notion is also backed up by the more recent research of Putrevu *et al.* (2004) who found that technically complex advertisements achieve better results for high-knowledge consumers. Moreover, Meeds (2004) concludes that consumers with higher knowledge possess better properties to evaluate product-related information presented in advertisements compared to consumers with medium or no knowledge. Against this background, we expect that for high-tech products, technically complex messages will generate the best results for individuals with high product involvement and, in contrast, technically simple messages will generate the best results for medium- and low-involvement individuals. Therefore, we formulate the following hypotheses:

H1. For low-involvement individuals, a technically simple ad will generate a more positive attitude towards the ad (a), a more positive attitude towards the product (b), and greater behavioural intention (c) than a technically complex ad.

H2. For medium-involvement individuals, a technically simple ad will generate a more positive attitude towards the ad (a), a more positive attitude towards the product (b), and greater behavioural intention (c) than a technically complex ad.

H3. For high-involvement individuals, a technically complex ad will generate a more positive attitude towards the ad (a), a more positive attitude towards the product (b), and greater behavioural intention (c) than a technically complex ad.

Method

Experimental design

We used a 2 (technical complexity: low and high) × 3 (product involvement: low, medium, and high) between-subject design. Technical complexity was manipulated by varying the degree of technical language in two – apart from that – identical advertisements. Product involvement was manipulated by conducting an *ex post* classification of participants, following a procedure similar to that applied by Yoon and Tinkham (2013). Accordingly, participants were divided into three groups of the same size based on their scores on a product involvement scale (split scores of 4.85 and 5.80). This resulted in a low-involvement group ($n = 107$; $M = 3.79$), a medium-involvement group ($n = 107$; $M = 5.32$), and a high-involvement group ($n = 108$; $M = 6.40$; $F(2, 319) = 553.53$, $p < 0.01$).

Stimuli

We developed two print advertisements for the experiment, a technically simple and a technically complex one. As the research object, we chose an advertisement of a hybrid car for two reasons: first, in the automotive industry, great emphasis is placed on technological innovations, which often leads to an increased level of technical complexity. It was thus possible for us to select technologies for the study from a wide variety of technical innovations (in this case a car with hybrid drive technology). Second, cars were suitable for our research purpose because the participants were very likely to be familiar with car advertisements.

In particular, the two car ads showed a new Audi A3 e-tron, a plug-in hybrid electric car (Audi, 2015), which represents a relatively new technology in the market. The ads for the experiment were based on an existing Audi A3 e-tron print advertisement. As shown in

Figure 1, the ads were almost identical. The lower half of the ads showed the front perspective of the product. The upper half (aligned to the right) contained the textual elements. At the top of the ads, the brand name, slogan, and logo were displayed. Underneath, the ads showed a headline and copy-text, representing the manipulated ad elements (see also Table I). In other words, the two ads were completely similar except for the headline and the copy-text. The headlines contained short statements, namely, "Runs on electricity and gas" for the simple ad, and "Plug-in hybrid with 6-speed S tronic" for the complex ad. The copy-text presented further information on the hybrid technology.

The simple ad communicated the information using language that is easily understandable, whereas the complex ad contained a high level of technical language. This manipulation approach is based on the understanding of technical ad complexity proposed by Anderson and Jolson (1980) and also successfully applied by Putrevu *et al.* (2004). In our study, although both copy-texts varied in terms of technical language, both contained the same product features. The first sentence repeated the fact that the advertised car runs on both electricity and gas. Then, information about the car's range and emission were given, followed by an explanation of the technology's benefit, namely, driving pleasure. For the copy-text, we critically ensured that lexical and informational complexity (Putrevu *et al.*, 2004) were kept on a constant level, with the objective of diminishing any unplanned variation. For example, the length of both copy-texts was nearly identical (53 words for the simple ad, 54 words for the complex ad). Finally, between the headline and the copy-text, both ads displayed the product name. Underneath the copy-text, the ads presented a short product slogan ("Changes the world. Not everyday life") to keep the ads as realistic as possible. Based on our way of manipulating the two ads, the variation in our study is very conservative compared, for instance, to the study on ad complexity by Putrevu *et al.* (2004). Our conservative approach involved the risk of provoking responses that are too weak to measure them; however, we believe that – with this cautious manipulation – significant effects imply very good external validity.

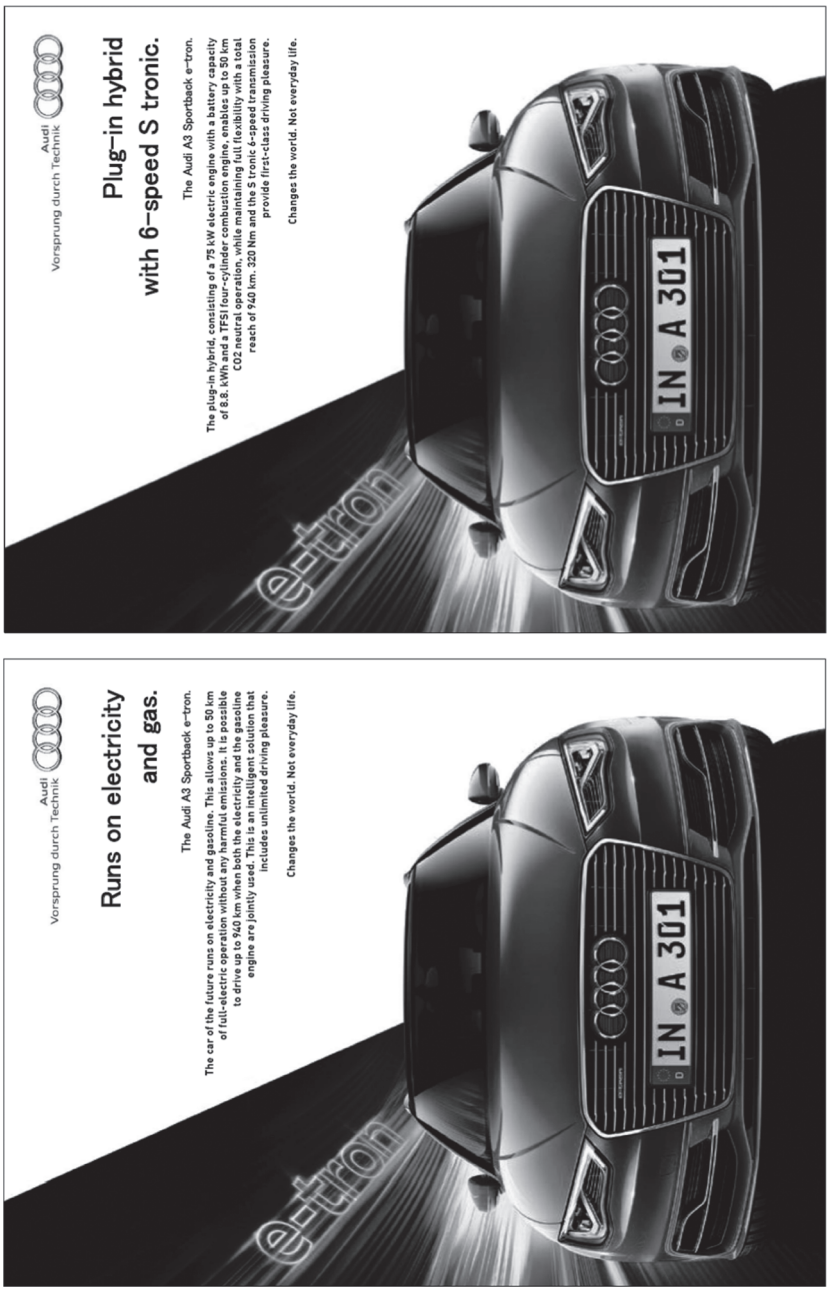
Pre-test

To check whether the complexity manipulation in the two ads was sufficient, a pre-test with 20 graduate students was conducted. Perceived technical complexity was measured by using a one-item, seven-point semantic differential scale (technically simple/technically complex). The results showed that the technically complex ad ($M = 5.30$) was perceived as significantly more complex than the technically simple ad ($M = 3.10$; $F\ (1, 18) = 14.05$, $p < 0.01$, $\eta_p^2 = 0.438$).

Measures

All applied scales ranged from 1 to 7. As a basis for the manipulation check, perceived technical complexity was measured as previously applied in the pre-test using a seven-point semantic differential scale (technically simple/technically complex). Product involvement was assessed with a ten-item semantic differential scale (unimportant/important, boring/interesting, irrelevant/relevant, unexciting/exciting, means nothing/means a lot to me, unappealing/appealing, mundane/fascinating, worthless/valuable, uninvolving/involving, not needed/needed) ($\alpha = 0.93$) (Zaichkowsky, 1994).

Communication effectiveness was measured on three levels. First, attitude towards the ad was assessed with a four-item semantic differential measure (not interesting/interesting, uninformative/informative, unbelievable/believable, unpleasant/pleasant) ($\alpha = 0.71$) (adapted from Geuens *et al.*, 2011). Second, attitude towards the product was measured using a four-item semantic differential scale (good/bad, like very much/dislike very much, favourable/unfavourable, valuable/worthless) ($\alpha = 0.92$) (Gill *et al.*, 1988). Third, behavioural intention was measured with two Likert scale items (not at all/very much) using the



Source: Courtesy of Audi AG

Figure 1.
Test stimuli: technically simple vs complex ad

Simple ad	Complex ad
Headline (Manipulation 1)	
Runs on electricity and gas	Plug-in hybrid with 6-speed S tronic
Copy-text (Manipulation 2)	
The car of the future runs on electricity and gasoline. This allows up to 50 km of full-electric operation without any harmful emissions. It is possible to drive up to 940 km when both the electricity and the gasoline engine are jointly used. This is an intelligent solution that includes unlimited driving pleasure	The plug-in hybrid, consisting of a 75 kW electric engine with a battery capacity of 8.8 kWh and a TFSI four-cylinder combustion engine, enables up to 50 km CO_2 neutral operation, while maintaining full flexibility with a total reach of 940 km. In total, 320 Nm and the S tronic 6-speed transmission provide first-class driving pleasure

Table I. Overview of manipulated elements

Note: The experiment was conducted in German and the reported word counts relate to the original ad versions

following questions: "How likely is it that you will consider buying a car with an alternative drive system in the near future?" and "How likely is it that you will own a car with an alternative drive system in the near future?" ($\alpha = 0.65$) (adapted from Naylor *et al.*, 2012).

As control variables, we included gender and self-assessed knowledge about cars in our considerations. Knowledge was measured using a three-item, seven-point Likert scale (not at all/very much) with the following questions: "Generally, how knowledgeable are you about cars?", "How knowledgeable are you about cars, as compared to your friends and acquaintances?", and 'How knowledgeable are you about cars, as compared to "car experts"?' ($\alpha = 0.91$) (adapted from Putrevu *et al.*, 2004).

Procedure and sample

We conducted a paper-and-pencil experiment with a total of 322 undergraduate ($n = 102$) and graduate ($n = 220$) students with a background in business or engineering at a major German university. Neither the area of study (business/engineering), nor the study phase (undergraduate/graduate) showed a significant interaction with technical ad complexity on the dependent variables ($ps > 0.1$). Clearly, the sample does not claim to be a representative cross-section of car buyers; instead, we decided to use a student sample because it features a high level of homogeneity, which suits the purpose of this experimental study (Koschate-Fischer and Schandelmeier, 2014; Lynch, 1982).

In multiple sessions, the participants were randomly assigned to one of the two questionnaires, which contained either the technically simple or the technically complex ad. The items of adapted measures were translated into German and back-translated to ensure consistency (Hoskisson, 2000). During the sessions, participants were told to start with the first page of the questionnaire and not to skip back after finishing a page. Before ad exposure, respondents reported the product involvement and knowledge scales. Directly after ad exposure, participants reported perceived technical complexity (manipulation check), followed by the attitude scales, behavioural intention, and finally demographic data.

Results

Manipulation check

A manipulation check confirmed that the technically complex ad ($M = 4.55$) was perceived as significantly more complex than the technically simple ad ($M = 3.02$; $F(1, 320) = 78.10$, $p < 0.01$, $\eta_p^2 = 0.196$), suggesting a successful manipulation of technical complexity in the two ads.

Main effects

A multivariate analysis of covariance (MANCOVA), with the control variables gender and knowledge as covariates, showed significant effects of product involvement on attitude towards the ad ($F(2, 314) = 15.98$, $p < 0.01$, $\eta_p^2 = 0.092$) and on attitude towards the product ($F(2, 314) = 13.08$, $p < 0.01$, $\eta_p^2 = 0.077$), but no effect on behavioural intention ($p > 0.1$). For attitude towards the ad and attitude towards the product, *post hoc* Bonferroni pairwise comparisons revealed that high- and medium-involvement individuals generally responded more favourably to the ads than low-involvement individuals ($ps < 0.01$). There was no difference between high- and medium-involved individuals ($ps > 0.1$). In regard to technical complexity, no direct effects on the dependent variables were detected ($ps > 0.1$). The analysis further demonstrated that the control variables gender and knowledge had no significant effects on the three dependent variables (all $ps > 0.1$).

Hypotheses testing

The MANCOVA furthermore revealed a significant interaction of product involvement and technical complexity on attitude towards the ad ($F(2, 314) = 3.57$, $p < 0.05$, $\eta_p^2 = 0.022$) and on attitude towards the product ($F(2, 314) = 4.46$, $p < 0.05$, $\eta_p^2 = 0.028$). To fully disclose this interaction, we individually analysed the simple effects of technical complexity on consumer responses at all levels of product involvement (see Table II). This was done by separately conducting a multivariate analysis of variance (MANOVA) with all dependent variables at each of the three product involvement levels. To ensure that the control variables gender and knowledge did not influence the analysed effects at this point, we additionally conducted a MANCOVA, with gender and knowledge as covariates, at each of the three involvement levels. These analyses showed that including or excluding the two control variables did not bias any inferences based on our model. In the following, we report the MANOVA results for clarity in presentation.

Low-involvement individuals. *H1* assumed that low-involvement individuals would respond more favourably to the simple ad compared to the complex ad. In fact, low-involvement participants showed a significantly more positive attitude towards the simple ad ($M = 4.59$) than towards the complex ad ($M = 4.06$; $F(1, 105) = 7.41$, $p < 0.01$, $\eta_p^2 = 0.066$), thereby supporting *H1a*. Likewise, we confirm *H1b* because the low-involvement group also had a significantly more positive attitude towards the product when exposed to the simple ad ($M = 5.05$) than when exposed to the complex ad ($M = 4.56$; $F(1, 105) = 5.09$, $p < 0.05$, $\eta_p^2 = 0.046$). No significant effect was found for behavioural intention ($p > 0.1$). Thus, *H1c* cannot be confirmed.

Medium-involvement individuals. *H2* predicted that the medium-involvement group would respond more positively to the simple ad than to the complex ad. Our analysis does not confirm this prediction. Conversely as expected, medium-involvement participants, who were assigned to the complex ad, had a more positive attitude towards the product

Product involvement	Attitude towards the ad			Attitude towards the product			Behavioural intention		
	Simple	Complex	Sig.	Simple	Complex	Sig.	Simple	Complex	Sig.
Low	4.59 (0.85)	4.06 (1.13)	0.008	5.05 (1.15)	4.56 (1.10)	0.026	4.01 (1.76)	4.27 (1.60)	0.420
Medium	4.92 (0.79)	4.87 (0.85)	0.745	5.13 (1.07)	5.53 (0.83)	0.039	4.66 (1.27)	4.14 (1.56)	0.063
High	5.02 (1.10)	5.15 (0.87)	0.493	5.47 (1.28)	5.56 (1.11)	0.690	4.74 (1.69)	4.14 (1.62)	0.062

Note: $n = 322$

Table II.
Cell means and standard deviations

($M = 5.53$) than the simple ad group ($M = 5.13$; $F\ (1, 105) = 4.39$, $p < 0.05$, $\eta_p^2 = 0.040$). Therefore, *H2b* cannot be confirmed. Due to a lack of significance for attitude towards the ad ($p > 0.1$) and behavioural intention ($p > 0.05$), *H2a* and *H2c* were also not supported.

High-involvement individuals. Finally, *H3* suggested that high-involvement individuals would respond more favourably to the complex ad than to the simple ad. However, no significant effects occurred for attitude towards the ad ($p > 0.1$), attitude towards the product ($p > 0.1$), and behavioural intention ($p > 0.05$). Thus, *H3a*, *H3b*, and *H3c* are not supported.

The interaction effects on attitude towards the ad and attitude towards the product are visually presented in Figures 2 and 3. Due to a lack of significance, we did not present a diagram for behavioural intention.

General discussion and conclusion

This study examined the impact of technical complexity on advertising effectiveness in the context of a technological innovation. As a potential moderator of this effect, we additionally considered consumers' product involvement. Advertising effectiveness was measured by attitude towards the ad, attitude towards the product, and by behavioural intention. Hence, our study offers a variety of theoretical and practical implications that are particularly useful for marketers of technological innovations and which will be discussed below.

First of all, our findings show a strong relationship between product involvement and response measures – regardless of the complexity level. Although attitudes towards the ad and product were not significantly better for high- compared to medium-involvement participants, low-involvement individuals reported significantly less favourable attitudes towards the ad and product than medium- and high-involvement individuals.

Furthermore, we could not detect a direct significant effect of technical complexity on advertising effectiveness. This result reinforces the view of Chamblee *et al.* (1993) that the conventional advice of "keep it short and simple" is not generally valid when aiming to increase advertising effectiveness. It is therefore reasonable to suggest that marketers need to adopt a more sophisticated approach when communicating high-technology products; this is also supported by the following results.

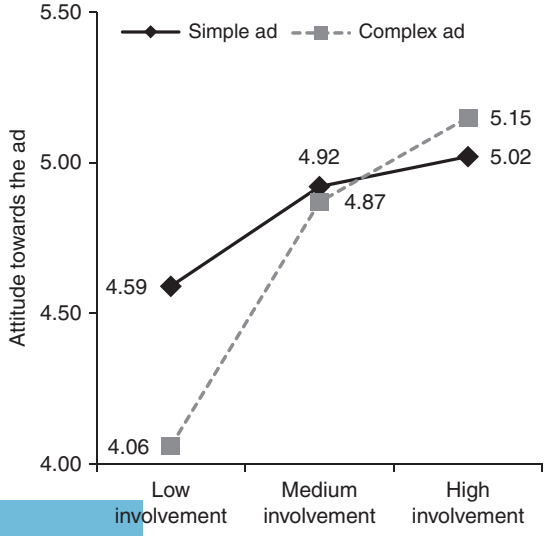


Figure 2.
Attitude towards the ad

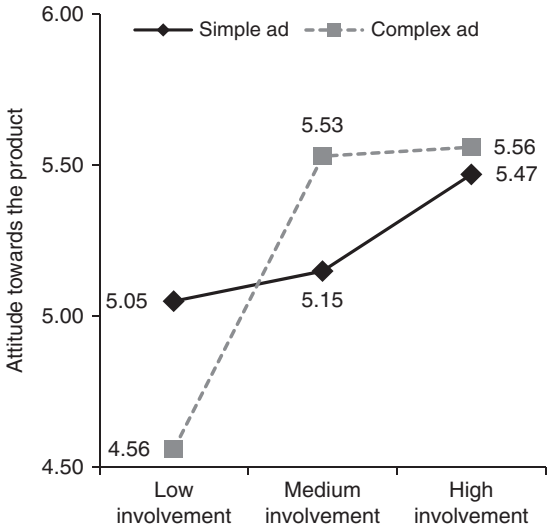


Figure 3.
Attitude towards the product

Although there was no overall effect of technical complexity on communication effectiveness, we nevertheless revealed that the effect is moderated by consumers' level of product involvement. In particular, we found that individuals with a low product involvement show more favourable responses (in attitude towards the ad and product) when exposed to technically simple advertisements. This result supports the notion that consumers with low involvement could lack the motivation to properly process advertisements with a high degree of technical complexity. Individuals with a medium level of product involvement reported more positive attitudes towards the advertised product when exposed to the complex ad. Finally, individuals who reported high product involvement were revealed to be indifferent regarding the level of technical complexity in an advertisement.

These findings partially contradict existing research. Previous studies reported that high-involvement individuals are better able to process complex advertisements, thus resulting in more positive attitudes (Cacioppo and Petty, 1984; Petty and Cacioppo, 1986). Our results, however, imply that high-involvement consumers generally show a high elaboration likelihood, no matter how complex a message is. To a certain extent, they are not influenced by the degree of technical complexity in high-tech advertisements. Generally, favourable consumer attitudes may occur due to the fact that high-involvement consumers implicitly favour a certain product – regardless of its communication approach.

Moreover, our study provides proof that consumers with medium involvement show a more favourable attitude towards the product when they are exposed to a technically complex ad. This finding is particularly interesting because it indicates that complex messages could also be more effective for individuals who do not fully grasp all issue-related arguments but who might be more positive about arguments that are directly related to the product. This finding stands clearly in contrast to previous suggestions that simpler content is superior (Pieters *et al.*, 2010; Putrevu *et al.*, 2004). One possible explanation might be that consumers with at least medium product involvement expect high-tech products to be complex to a certain degree. Hence, technical complexity in an ad might be a stylistic device to suggest the superiority of the product or technology.

Regarding the practical implications, our study offers several insights for marketers of technological innovations. First, if it is not possible to reveal the involvement level of the target audience or if the target audience contains individuals of all levels of involvement,

technically simple ads should be used. Second, marketers should furthermore use simple ads if messages are specifically targeted at a low-involvement audience. Third, if marketers are confronted with a high-involvement audience, they can be more flexible in designing their messages because of the general high elaboration likelihood of this group. It is thus possible to achieve high communication effectiveness with both technically simple and complex ads. Fourth, if marketers know that their target audience does not contain low-involvement individuals (at least medium involvement, which was two-thirds of our sample), then a technically complex ad might be more effective than a simple one because medium-involvement individuals respond more positively to complex ads and high-involvement consumers were revealed to be indifferent.

Overall, no significant differences could be detected for behavioural intention. Since behavioural intent is a considerably stronger response compared to an attitude change, this finding is somehow not surprising. Different levels of technical complexity might not be sufficient to trigger behavioural responses. Future studies could try to analyse the interplay of technical complexity with other independent variables in order to fully understand the persuasive influence of technical complexity in high-technology advertisements. The hypotheses and results are briefly summarised in Table III.

Limitations and future research

The limitations of our research offer several directions for future research. First, we used an Audi A3 e-tron advertisement as the research object. Therefore, our findings cannot simply be transferred to other high-technology product categories. Further research could examine whether our findings are applicable to other industry settings. Second, the ads focussed on plug-in hybrid technologies. We suggest that not only might the product category have an influence on the examined effects but the character or nature of a technology could also possibly influence the underlying effects. Future studies could thus examine the role of different technologies for advertising purposes. Third, we manipulated technical complexity by varying the level of technical language in the headline and copy-text of the ads. There are, however, other determinants of technical complexity, such as the technical complexity which is manipulated via visual elements. It is therefore necessary to further study the determinants of perceived complexity in advertising. Fourth, we applied product involvement as a moderator of the effect between technical ad complexity and advertising effectiveness. Although our study did not indicate the influence of gender and product knowledge, there might be other personal characteristics which moderate the examined effect. Future studies could search for those characteristics to further optimise advertising activities in the context of high-technology products.

Table III. Summary of the hypotheses

Hypotheses		Attitude towards the ad	Attitude towards the product	Behavioural intention
H1	Low-involvement individuals respond more favourably to the simple ad than to the complex ad	Supported (*H1a*)	Supported (*H1b*)	Not supported (*H1c*)
H2	Medium-involvement individuals respond more favourably to the simple ad than to the complex ad	Not supported (*H2a*)	Not supported (*H2b*)	Not supported (*H2c*)
H3	High-involvement individuals respond more favourably to the complex ad than to the simple ad	Not supported (*H3a*)	Not supported (*H3b*)	Not supported (*H3c*)

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