Effects of Animation and Rotoscoping In Direct-to-Consumer Rx TV Advertising

How Animation vs. Rotoscoping vs. Live Action Drive Perceptions and Attitudes toward Drugs

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This study experimentally tested the effects of animation versus rotoscoping versus live action in direct-to-consumer television advertising on outcomes, including risk and benefit perceptions and attitudes toward the drug. The authors used an online panel to recruit participants with chronic dry eye (n = 504) and psoriasis (n = 490). The study found no effects of animation or rotoscoping on perceptions of drug risk or benefit, comprehension, or behavioral intentions. Animated advertisements, however, resulted in more negative attitudes than live-action or rotoscoped advertisements. Future research should explore whether animated advertisements are recalled better over time or have any lagged effects on perceptions.

INTRODUCTION

Advertising professionals use many techniques to increase consumer interest in their advertisements, including traditionally animated fictional or nonfictional and human or nonhuman spokescharacters (Callcott and Lee, 1995). Despite variations in form, animated characters have been used in low-involvement products (*e.g.*, food products) for years to grab attention, increase advertisement memorability, and enhance persuasion with the ultimate goal of driving behavior (Bell, 1992; Diao and Sundar, 2004; Fox, Lang, Chung, Lee, *et al.*, 2004; Garretson and Niedrich, 2004; Heiser, Sierra, and Torres, 2008; Leiner, Handal, and Williams, 2004; Luo, McGoldrick, Beatty, and Keeling, 2006). More recently, they have also made their way into direct-to-consumer prescription drug advertising. Animated characters have been used in direct-to-consumer advertisements for Lamisil, Lunesta, and Xifaxan, among others, whereas rotoscoping has been used in at least one direct-to-consumer advertisement (Abilify; Clayton and Leshner, 2015). The use of brand names does not imply endorsement.

Unlike most other consumer product categories, prescription drugs can carry serious risks. Given this possibility, the Food and Drug Administration (FDA) is tasked with ensuring that

Management Slant

- The study found no effects of animation or rotoscoping on perceptions of drug risk or benefit, comprehension, or behavioral intentions.
- Animated advertisements resulted in more negative attitudes toward the character, advertisement, and product.
- Effects on attitudes appear to occur through several mediators, including identification with the character, positive and negative affect toward the character, and perceptions of character eeriness.
- The study should be replicated with a longitudinal design to determine whether negative attitudes influence drug information recall over time.

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The presentation style of an advertisement, including animation or rotoscoping, becomes important if it has the potential to disrupt consumer processing of this essential information.

direct-to-consumer prescription drug broadcast advertisements provide a true statement of major side effects, contraindications, and effectiveness (21 CFR 202.1(e)) as well as a fair balance of benefits and risks (21 CFR 202.1(e)(5)(ii); to that end, the FDA works to ensure that consumers and potential patients understand the trade-offs of risks and benefits of prescription drugs as much as possible. The presentation style of an advertisement, including animation or rotoscoping, becomes important if it has the potential to disrupt consumer processing of this essential information. This study aimed to examine whether tactics such as using animation or rotoscoping in drug advertisements inflates efficacy perceptions, minimizes risk, or otherwise hinders comprehension of drug risks and benefits.

THEORETICAL BASIS

Using animated characters may allow marketers to explain product benefits in an engaging and even humorous manner; however, although this tactic may increase involvement with the characters in the advertisement because they are perceived as engaging and likeable, it may not increase involvement with the message itself or the comprehension of risk and benefit information. This is potentially problematic, as consumers may remember the product or brand name or form a positive opinion about the product without fully understanding or considering its attributes. The majority of research on animated characters in advertising focuses on outcomes such as product evaluations (Chandler and Schwartz, 2010), affective responses (Callcott and Lee, 1995; Callcott and Phillips, 1996; Garretson and Niedrich, 2004), brand attitudes (Bhutada, Rollins, and Perri, 2017; Delbaere, McQuarrie, and Phillips, 2011), and perceived product value (Hart, Jones, and Royne, 2013). Whether animated characters lead to reduced comprehension of risk and benefit information in prescription drug advertisements is an important and open question.

The uncanny valley theory is relevant when describing the relation between how humanlike a character looks and the emotional response that it may trigger. For rotoscoping in the context of advertising, the uncanny valley theory (Clayton and Leshner, 2015) would posit that characters that closely resemble human beings, but are eerily unnatural in movement or appearance, would evoke discord in the viewer and a sense of revulsion. In other words, the emotionally off-putting eeriness of certain techniques—in this case, rotoscoping, which involves tracing live-action images frame by frame to create animated characters—may cause an aversive reaction that may inhibit recall and cause negative feelings. In that regard, one group found that memory for risk information was reduced in their rotoscoped advertisement clips versus their live-action advertisement clips (Shah *et al.*, 2019). They explained these effects as a disruption of encoding, at least partially as a result of the uncanny valley theory; however, they did not provide an explanation for why this disruption would occur primarily during the risk segments compared with the benefit segments, other than to dismiss novelty as the cause. They also did not examine animated figures or characters.

That group also found that exposure to rotoscoped advertisement clips versus live-action clips reduced negative perceptions of risks. When examining the placement of the rotoscoped characters within the clip, they found that rotoscoping during delivery of risk resulted in more positive perceptions compared with findings for the advertisements in which the rotoscoping was used during the delivery of benefit information or the live-action advertisement. It is possible that the rotoscoped character activated an aversive response during the risk portion of the clip, consistent with the uncanny valley theory assumptions. This may have then distracted the viewer from the risk information, making the benefits of the drug more prominent, which, in turn, resulted in more favorable feelings toward the drug.

On the basis of the uncanny valley theory, the authors would expect that an advertisement featuring a rotoscoped human character would activate the aversive motivational system (Cacioppo, Gardner, and Berntson, 1999), leading to withdrawal from the advertisement, lower attention, and reduced memory of message content (Lang, 2000). Consistent with Shah *et al.* (2019), the authors expected that they might also find positive perceptions about the drug for those in the rotoscoped condition, given their distraction from important risk information. An animated nonhuman character, on the other hand, may not evoke the eerie feelings expected of a rotoscoped human character. Research is mixed, however, on whether the animated advertisement will be seen as more (Callcott and Phillips, 1996; Heiser *et al.*, 2008) or less (Bhutada *et al.*, 2017; Luo *et al.*, 2006) positive than a live-action advertisement and whether that will impact memory or subsequent perceptions about the drug.

Research on the affect heuristic also provides insights into the potential mechanism of influence that characters in advertisements may have on viewers' attitudes and perceptions toward the product. Affect refers to a feeling of positivity or negativity toward a stimulus (Slovic, Peters, Finucane, and MacGregor, 2005). The affect heuristic refers to a mental shortcut whereby judgments about an object, such as perceived risk and benefit, are based on affect rather than a complex retrieval and integration of information about the object's relevant attributes. Thus, in situations of low motivation or involvement, such as the viewing of direct-to-consumer advertisements, people who feel favorably about a stimulus (*e.g.*, advertisement, character) will make judgments aligned with that positive affect, such as greater perceived product benefits, or fewer risks; people who feel unfavorably about it will make judgments aligned with that negative affect, such as lower perceived product benefits, or greater risks.

Indeed, the affect heuristic has been cited as an explanation for the documented inverse relationship between perceived risks and benefits (Alhakami and Slovic, 1994; Finucane, Alhakami, Slovic, and Johnson, 2000). In the context of this study, the extent to which affective responses can be fostered by animated characters (including rotoscoped or nonhuman animation) is especially relevant, as the positive or negative feelings the different types of characters induce might be transferred to the advertisement or the product being advertised. The authors would expect that the affect heuristic has implications for the transfer of evaluative judgments from one object, such as an advertising character, to another, such as the advertisement or the product.

HYPOTHESES

This study examined how animation and rotoscoping influence perceptions and behavioral intentions in the context of television advertisements for two prescription drug products that treat different medical conditions.

The authors chose television advertisements versus other formats because prescription drugs are frequently advertised on television (Schwartz and Woloshin, 2019). Additionally, moving pictures in television advertisements may be more memorable than static pictures found in print advertisements (Matthews, Benjamin, and Osborne, 2007). Finally, the authors chose two medical conditions to increase the generalizability of the research as recommended by Shah *et al.* (2019). The authors did not conduct statistical analyses by medical condition, however, because characteristics of the medication profiles and advertisements vary across medical conditions. The authors examined the two medical conditions descriptively as a form of replication. They focused on the following research questions:

RQ1: Does animation or rotoscoping in direct-to-consumer television advertisements influence the processing of prescription drug information?

RQ2: Does the impact of animation or rotoscoping on processing of prescription drug information in direct-to-consumer television advertisements vary by medical condition?

The authors also developed five hypotheses:

H1: (Recall/recognition): Participants who see the animated or the live-action advertisement will show higher recall and recognition of benefit and risk information than those who see the rotoscoped advertisement. Differences between animated and live-action advertisements are exploratory.

H2: (Advertisement comprehension): Participants who see the animated advertisement will show greater overall advertisement comprehension, whereas those who see the rotoscoped advertisement will show lower comprehension than those who see the live-action advertisement.

H3: (Perceived benefit and risk): Participants who see the animated advertisement will have greater perceived benefit and lower perceived risk than those who see the live-action advertisement. Participants who see the rotoscoped advertisement will have lower perceived benefit and higher perceived risk than those who see the live-action advertisement.

H4: (Attitudes): Participants who see the animated advertisement will show more positive attitudes toward the character, the advertisement, and the product than those who see the live-action advertisement. Participants who see the rotoscoped advertisement will show less positive attitudes toward these objects than those who see the live-action advertisement

H5: (Behavioral intentions): Participants who see the animated advertisement will show greater product-related behavioral intentions, whereas those who see the rotoscoped advertisement will report lower intentions than participants who see the live-action advertisement.

This mediation analysis drew from other published literature indicating that identification with a character leads people to take a less critical stance toward brands and media texts such as advertising.

In a *post hoc* analysis, the authors also examined whether the effect of animation and rotoscoping on observed changes in attitudes toward the character, advertisement, and product could be explained by viewers' identification with the main character, affective reactions toward the character, and perceived eeriness of the character. This mediation analysis drew from other published literature indicating that identification with a character leads people to take a less critical stance toward brands and media texts such as advertising (Bhatnagar and Wan, 2011; Cohen, 2001; Fiske, 19[illegible] affective responses toward advertising are linked to subsequent changes in attitudes (Cartwright, McCormick, and Warnaby, 2016; Holbrook and Batra, 1987; Yoo and Kim, 2005); and, as mentioned earlier, perceived eeriness evokes aversive responses toward messages (Cacioppo *et al.*, 1999; Clayton and Leshner, 2015; Lang, 2000). The authors' *post hoc* analysis builds on these other studies by comparing all three types of animation strategies.

METHOD

The authors tested the effects of animation and rotoscoping using a main-effects, between-subjects experiment (live action versus rotoscoped versus animated) replicated among two samples: participants suffering from chronic dry eye and participants suffering from psoriasis. For each medical condition, the authors developed three fictitious direct-to-consumer prescription drug advertisements that differed only by the type of strategy used to portray the main character. The authors provide examples of the main characters (See Figure A1 in the Appendix). To maintain experimental control of advertisement elements outside of the main characters, the authors used the same theme, superimposed text, background music, and main character voice in all advertisements. Controlling these extraneous elements across advertisements served to reduce potential confounds and isolate the effects of the main character's appearance. The animated advertisement for the fictitious chronic dry eye treatment, Ocuzel, featured a space alien with a large eyeball for a head; and the animated advertisement for the fictitious psoriasis treatment, Xeravast, featured a fuzzy monster. The live-action advertisements featured human actors performing activities similar to those of the animated character, and the rotoscoped advertisements simply applied rotoscoping to the live-action advertisements.

Sampling and Procedure

The sample was recruited from an opt-in online panel and consisted of English-speaking adults who self-identified as having been diagnosed with chronic dry eye (sample 1) or psoriasis (sample 2). The authors excluded individuals who worked in the health care, marketing, advertising, and pharmaceutical industries. Participants were screened for eligibility, gave consent, were randomly assigned to experimental arm, were exposed to an advertisement, and were asked to complete a questionnaire. Cooperation rates (defined as the number of surveys completed divided by the number of people screened as eligible) were 88 percent among those with psoriasis and 83 percent among those with chronic dry eye.

Measures

Advertisement Comprehension. Participants were asked whether they correctly understood two risk and two benefit claims from the Xeravast/Ocuzel advertisement. These comprehension items, which were tailored to the specific risk and benefit claims, built on an overall comprehension measure from O'Donoghue, Johnson, Sullivan, Parvanta, *et al.* (2019). The authors summed the correct responses to create an overall advertisement comprehension index, which ranged from 0 to 4.

Benefit and Risk Recall. Participants were asked two open-ended questions in random order: "What are the side effects or risks of [Xeravast/Ocuzel]?" and "What are the benefits of [Xeravast/Ocuzel]?" The authors coded open-ended responses using two coders and tested for interrater reliability using Krippendorff's alpha as the reliability measure (Hayes and Krippendorff, 2007). The authors conducted five rounds of interrater reliability testing using subsets of the data—10 percent of responses per round. During each round, coders met to discuss discrepancies (alpha < 0.70), and the authors updated the codebook on the basis of their resolutions. They then coded all open-ended responses and achieved interrater reliability scores of 0.79 or higher for all codes. The authors created a dichotomous measure of benefit indication recall for those who correctly recalled the drug indication (1) versus those who did not (0). The authors also summed correct recall of the other drug benefits (0–4 benefits for psoriasis and 0–5 benefits for chronic dry eye) and correct recall of the drug risks (0–9

Participants reported how they felt about the character, advertisement, and product using 7-point ratings anchored by different attitude labels.

risks for psoriasis and 0–7 risks for chronic dry eye). An earlier study used similar procedures for measuring recall (Betts, Aikin, Kelly, Johnson, *et al.*, 2019).

Benefit and Risk Recognition. On the basis of O'Donoghue *et al.*'s (2019) study, participants were shown a list of four correct (two each about risks and benefits) and four foil claims and asked to indicate "Which of the following claims, if any, were in the advertisement you saw?" The authors created the benefit recognition index by summing the total number of accurate benefit statements recognized (0–2), and risk recognition was created by summing the total number of accurate risk statements recognized (0–2). The authors then dichotomized these index measures into recognition of two benefits (versus 0 or 1) and recognition of two risks (versus 0 or 1).

Perceived Efficacy and Risk Likelihood and Magnitude. The authors asked participants to indicate the likelihood that they would experience at least one side effect if they took the drug on a scale ranging from 1 (not at all likely) to 6 (extremely likely) and to indicate how serious the drug's side effects are on a scale ranging from 1 (not at all serious) to 6 (very serious). The authors also asked participants to indicate the likelihood that Xeravast/Ocuzel would relieve their psoriasis/chronic dry eye symptoms if they took it on a scale from 1 (not at all likely) to 6 (extremely likely). In response to a separate question, participants reported the extent to which they agreed that taking Xeravast/Ocuzel would probably help their psoriasis/chronic dry eye on a scale ranging from 1 (strongly disagree) to 6 (strongly agree). These measures were adapted from a previous validation study (Kelly *et al.*, manuscript under review)

Attitudes toward the Character, Advertisement, and Product. Participants reported how they felt about the character, advertisement, and product using 7-point ratings anchored by different attitude labels. Ratings for attitude toward the character and product included "bad/good," "unpleasant/pleasant," and "dislike/like." Ratings for attitude toward the advertisement included "bad/good," "low quality/high quality," and "unprofessional looking/professional looking." Bergkvist and Rossiter (2007) and Russell and Stern (2006) used similar attitude measures. They averaged scores for each set of items to create three continuous attitude scales. All three scales had good reliability (Cronbach's alpha > .88 for each index, across both illnesses).

Behavioral Intentions. Using a scale ranging from 1 (not at all likely) to 7 (extremely likely), the authors asked participants to indicate how likely they would be to take [Xeravast/Ocuzel] if their doctor prescribed it. According to a previous study, behavioral intention is a predictor of future behavioral performance (Fishbein and Ajzen, 2010).

Perceived Eeriness. The authors asked participants to rate the extent to which they felt that the main character in the advertisement was eerie, with response options ranging from 1 (not at all eerie) to 7 (totally eerie). This measure came from Burleigh, Schoenherr, and Lacroix (2013); Kätsyri, Mäkäräinen, and Takala (2017) used a similar measure.

Identification with the Character. On the basis of Bhatnagar and Wan's (2011) study, the authors asked participants to indicate how similar they thought they were to the main character in the advertisement, with response options ranging from 1 (not at all similar) to 7 (extremely similar). Participants also reported the extent to which they agreed with the two statements, "I can identify with the main character" and "I can easily put myself in the shoes of the main character," with response options ranging from 1 (strongly disagree) to 7 (strongly agree). The authors averaged responses to these three statements to form the identification toward the character scale, which showed good internal consistency (Cronbach's alpha ≥ 0.94).

Positive and Negative Affect. The authors asked participants how the main character made them feel regarding six emotions ("disgusted," "uncomfortable," and "fearful" to capture negative affect and "happy," "hopeful," and "empowered" to capture positive affect). Response options for each emotion ranged from 1 (did not feel this way at all) to 7 (felt this way very strongly). The authors adapted these affect measures from Burleigh *et al.* (2013); Ho, MacDorman, and Pramono (2008); and Richins (1997). The authors averaged responses to the three positive emotions and separately averaged responses to the three negative emotions to form the scales measuring positive and negative affect toward the character. Both scales had good internal consistency (Cronbach's alpha ≥ 0.85).

ANALYSES

The authors conducted two types of analyses: bivariate analyses to examine hypothesized effects of animation and rotoscoping on each outcome and path analyses to examine indirect effects through potential mediators.

For the bivariate analyses, the authors used analysis of variance (ANOVA) to test effects when the outcome was continuous and logistic regression to test effects when the outcome was binary. In two instances (*i.e.*, risk recall and recall of other benefits, excluding the indication) the data did not meet ANOVA test assumptions because of skewness; thus, the authors conducted Poisson regressions, which are robust to skewed distributions. To account for multiple comparisons, the authors used a Bonferroni correction to adjust significance thresholds. Only p values < .025 were considered statistically significant when a two-level comparison was hypothesized, and p values < .0167 were considered statistically significant when three-level comparisons were hypothesized.

The authors tested path models to examine potential mechanisms that might explain observed bivariate effects of animation and rotoscoping on attitudes toward the character, advertisement, and product. These paths were not prespecified in the initial study hypotheses and are therefore considered exploratory. These mechanisms, or mediator variables, included identification with the character, positive and negative affect toward the character, and perceived character eeriness. The authors tested pathways between the independent variable (live action versus animation versus rotoscoping) and the proposed mediator variables (identification, affect, and eeriness), pathways between the mediator variables and the dependent variables (attitudes toward the character, advertisement, and product), and indirect effects of the independent variable on the dependent variables through the mediator variables. The authors interpreted the indirect effects only if relationships between the independent variable and mediator variables, and between the mediator variables and the dependent variables, were significant.

The authors ran the path models separately for chronic dry eye and psoriasis. The reference category for experimental condition in all models was the animated advertisement to allow for comparisons between the animated and live-action advertisements and the animated and rotoscoped advertisements. To assess model fit, the authors examined the coefficients for root-mean-square error of approximation (RMSEA), standardized root-mean-square residual (SRMR), Tucker-Lewis index (TLI), and Bentler comparative fit index (CFI). The authors assumed the cutoff for good model fit to be: RMSEA < 0.06, SRMR < 0.08, TLI > 0.95, and CFI > 0.95 (Hooper, Coughlan, and Mullen, 2008; Hu and Bentler, 1999). The authors report the unstandardized coefficients and their associated p values for the direct and indirect effects. Significance was assessed using ps < .025 to account for the two comparisons between those in the live-action condition versus animated condition and those in the rotoscoped condition versus animated condition.

RESULTS

Sample Characteristics

The psoriasis sample comprised 489 participants. Of these, 231 (47.2 percent) were men, and 431 (88.1 percent) were White. Education was dispersed, with 73 (14.9 percent) having completed high school or less, 109 (22.2 percent) having completed some college, 160 (32.7 percent) having a college degree, and 148 (30.2 percent) having a postgraduate degree. The chronic dry eye sample comprised 504 participants, 132 (26.2 percent) of whom were men and 449 (89.1 percent) of whom were White. Education was evenly dispersed, with 124 (24.6 percent) having completed high school or less, 138 (27.4 percent) having completed some college, 122 (24.2 percent) having a college degree, and 120 (23.8 percent) having a postgraduate degree. Roughly half of participants in the psoriasis sample (54.3 percent) and 26.2 percent of the chronic dry eye sample were currently taking a prescription drug for their condition. Close to half of the chronic dry eye sample (44.9 percent) had never taken prescription medication for their condition.

Main Effects of Type of Animation. The authors present the effects of the experimental conditions on each outcome in the psoriasis and chronic dry eye samples (See Tables 1 and 2, respectively). They found no significant effects in either medical condition or experimental condition on benefit and risk recall and recognition (H1), advertisement comprehension (H2), perceived benefits or risks (H3), or behavioral intentions (H5).

Attitudes Toward the Character, Advertisement, and Product. H4 was partially supported. Consistent with the authors' hypothesis, those in the live-action condition reported significantly more positive attitudes toward the advertisement than those in the rotoscoped condition in both the psoriasis and chronic dry eye samples (See Tables 1 and 2). In the chronic dry eye sample only, those in the live-action condition reported significantly more positive attitudes toward the character than those in the rotoscoped condition (See Table 2). Attitudes toward the character were similar between live-action and rotoscoped conditions in the psoriasis sample. The authors also found no differences between live-action and rotoscoped advertisements in terms of attitude toward the product in either medical condition. Counter to expectations, however, those who saw the animated advertisement reported significantly lower positive attitudes toward the character, advertisement, and

Table 1. Effects of Experimental Condition: Live Action versus Animated versus Rotoscoped—Psoriasis

	Live Action		Animated		Rotoscoped			
Variable	***n***	**%**	***n***	**%**	***n***	**%**	**Test Value**	***p***
Recognition								
Recognized two risks	78	50.3	87	47.0	84	56.0	2.68	.261
Recognized two benefits	86	55.5	100	54.1	73	48.7	1.59	.452
Recall								
Benefit—indication	33	21.3	44	29.3	37	20.0	4.50	.106
	Live Action		**Animated**		**Rotoscoped**			
Variable	***M***	***SE***	***M***	***SE***	***M***	***SE***	**Test Value**	***p***
Recall								
Risk	1.66	0.10	1.51	0.10	1.73	0.12	2.35[a]	.308[a]
Benefit—other	0.99	0.07	0.91	0.06	0.87	0.07	1.36[a]	.507[a]
Advertisement comprehension	3.24	0.08	3.03	0.08	3.12	0.08	1.79	.167
Risk perceptions								
Risk likelihood	4.09	0.11	4.13	0.11	4.10	0.12	0.04	.965
Risk magnitude	4.05	0.11	4.11	0.10	4.03	0.11	0.17	.844
Efficacy perceptions								
Efficacy likelihood	4.46	0.08	4.38	0.08	4.64	0.09	2.62	.074
Efficacy magnitude	4.37	0.09	4.46	0.09	4.23	0.08	1.76	.173
Attitudes								
Attitude toward the character	5.83	0.12	4.37*	0.11	5.64	0.12	43.41	**<.001**
Attitude toward the advertisement	5.80	0.11	4.53*	0.10	5.24*	0.12	35.95	**.001**
Attitude toward the product	5.10	0.11	4.75*	0.10	5.16	0.11	4.12	**.017**
Behavioral intention								
Intention to take the drug	4.96	0.15	4.57	0.13	4.83	0.15	2.04	.131

Note: The authors separated recall of the benefit indication versus other benefits given the substantive difference between recall of a general benefit (*e.g.*, treats psoriasis) and recall of specific benefits (*e.g.*, does not suppress immune system). [a] Means and standard errors are presented for descriptive statistics; however, significance testing was performed using Poisson regression assuming count distribution of the outcome data. *Significantly different from the live-action condition at the Bonferroni-adjusted $p < .025$.

product than did those in the live-action condition. This pattern was found across both the psoriasis and chronic dry eye samples (See Tables 1 and 2). Subsequently, the authors assessed potential mechanisms that may drive the observed effects of type of animation on attitudes using path analysis and tests of indirect effects.

Path Analysis and Indirect Effects

Psoriasis. The authors provide a summary of the path analysis results for both the psoriasis and chronic dry samples (See Figure 1 and Table A1 in the Appendix). In the psoriasis sample, the fit indices for the authors' proposed model were at or above the threshold for adequate fit (*i.e.*, RMSEA = 0.10, SRMR = 0.03, TLI = 0.91, and CFI = 0.98). The covariance matrix is also presented (See Table A2 in the Appendix). Tests of the direct paths between experimental condition and the authors' proposed mediators indicated that, compared with participants who saw the animated advertisement, those who saw the rotoscoped and live-action advertisements reported higher identification with the character ($B_{Rotoscoped} = 1.00$, $SE = 0.20$, $p < .001$; $B_{Live\ action} = 0.89$, $SE = 0.19$, $p < .001$), more positive affect toward the character ($B_{Rotoscoped} = 0.56$, $SE = 0.20$, $p = .005$; $B_{Live\ action} = 0.73$, $SE = 0.18$, $p < .001$), less negative affect toward the character ($B_{Rotoscoped} = -0.79$, $SE = 0.17$,

Table 2. Effects of Experimental Condition: Live Action versus Animated versus Rotoscoped—Chronic Dry Eye

	Live Action		Animated		Rotoscoped			
Variable	***n***	**%**	***n***	**%**	***n***	**%**	**Test Value**	***p***
Recognition								
Recognized two risks	82	46.3	91	54.2	75	47.2	2.50	.287
Recognized two benefits	99	55.9	86	51.2	81	50.9	1.09	.580
Recall								
Benefit—Indication	79	44.6	70	41.7	73	45.9	0.64	.728
	Live Action		**Animated**		**Rotoscoped**			
	M	***SE***	***M***	***SE***	***M***	***SE***	**Test Value**	***p***
Recall								
Risk	1.33	0.08	1.45	0.08	1.59	0.09	4.00[a]	.135[a]
Benefit—Other	0.73	0.07	0.76	0.07	0.84	0.07	1.12[a]	.570[a]
Advertisement Comprehension	3.29	0.07	3.26	0.07	3.38	0.07	0.77	.462
Risk Perceptions								
Risk likelihood	3.76	0.11	3.85	0.11	3.69	0.12	0.47	.623
Risk magnitude	4.11	0.11	4.29	0.11	4.14	0.11	0.74	.480
Efficacy Perceptions								
Efficacy likelihood	4.62	0.08	4.45	0.08	4.43	0.08	1.73	.179
Efficacy magnitude	4.58	0.09	4.32	0.09	4.42	0.09	2.23	.108
Attitudes								
Attitude toward the character	5.98	0.11	4.67*	0.11	5.52*	0.12	30.99	**<.001**
Attitude toward the advertisement	5.63	0.11	4.70*	0.11	5.07*	0.11	19.01	**<.001**
Attitude toward the product	4.90	0.11	4.40*	0.12	4.78	0.12	5.02	**.007**
Behavioral Intention								
Intention to take the drug	4.96	0.15	4.64	0.15	4.81	0.16	1.09	.336

Note: The authors separated recall of the benefit indication versus other benefits given the substantive difference between recall of a general benefit (*e.g.*, treats psoriasis) and recall of specific benefits (*e.g.*, does not suppress immune system). [a] Means and standard errors are presented for descriptive statistics; however, significance testing was performed using Poisson regression assuming count distribution of the outcome data. *Significantly different from the live-action condition at the Bonferroni-adjusted $p < .025$.

$p < .001$; $B_{\text{Live action}} = -0.86$, $SE = 0.16$, $p < .001$), and lower perceived character eeriness ($B_{\text{Rotoscoped}} = -0.50$, $SE = 0.08$, $p < .001$; $B_{\text{Live action}} = -0.79$, $SE = 0.07$, $p < .001$).

Direct paths between these mediator variables and attitudes toward the character, advertisement, and product were also significant in most instances. Specifically, identification with the character was positively associated with each attitudinal outcome ($B_{\text{Product}} = 0.26$, $SE = 0.04$, $p < .001$; $B_{\text{Advertisement}} = 0.27$, $SE = 0.04$, $p < .001$; $B_{\text{Character}} = 0.36$, $SE = 0.04$, $p < .001$), as was positive affect toward the character ($B_{\text{Product}} = 0.32$, $SE = 0.05$, $p < .001$; $B_{\text{Advertisement}} = 0.29$, $SE = 0.05$, $p < .001$; $B_{\text{Character}} = 0.25$, $SE = 0.04$, $p < .001$). Perceived character eeriness was negatively associated with attitudes toward the character ($B_{\text{Character}} = -0.57$, $SE = 0.08$, $p < .001$) and advertisement ($B_{\text{Advertisement}} = -0.48$, $SE = 0.09$, $p < .001$) only, and negative affect toward the character was negatively related to attitudes toward the character ($B_{\text{Character}} = -0.09$, $SE = 0.04$, $p = .029$) and product ($B_{\text{Product}} = -0.13$, $SE = 0.04$, $p = .002$) only.

In addition to these direct paths, results showed significant indirect effects of experimental condition on attitudes toward the character, advertisement, and product, and several mediators helped to explain these effects. For each of these findings, the authors

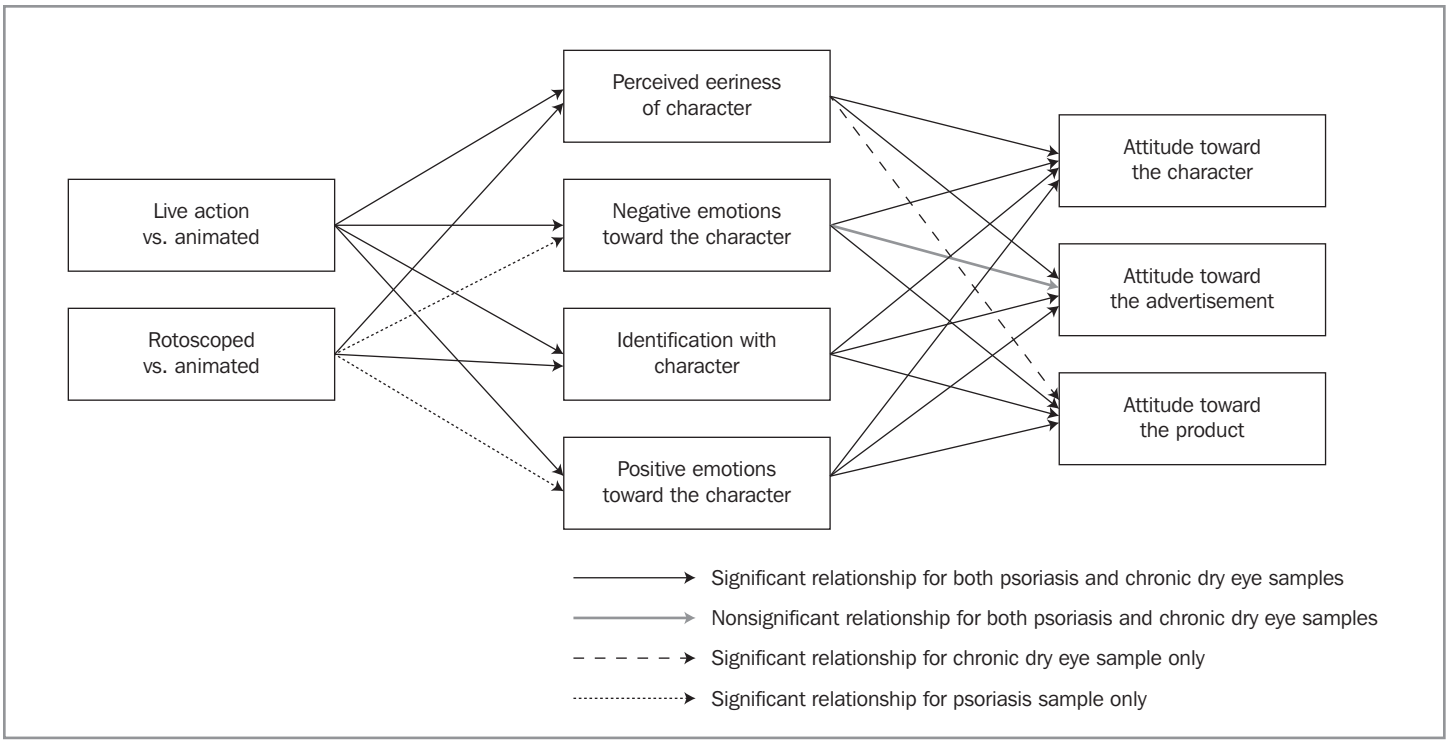

Figure 1 Results of Path Analysis

have assumed partial mediation. In other words, the authors do not claim that the parsimonious set of mediators that they tested should fully explain effects of experimental condition on attitudes. First, attitudes toward the character were more positive after seeing the rotoscoped and live-action advertisements versus the animated advertisement, partly because participants in the rotoscoped and live-action conditions reported higher identification with the character (rotoscoped: ab = 0.36, *SE* = 0.09, $p < .001$; live action: ab = 0.32, *SE* = 0.09, $p < .001$), higher positive affect toward the character (rotoscoped: ab = 0.14, *SE* = 0.06, $p = .018$; live action: ab = 0.18, *SE* = 0.06, $p = .002$), and lower perceived character eeriness (rotoscoped: ab = 0.29, *SE* = 0.07, $p < .001$; live action: ab = 0.45, *SE* = 0.08, $p < .001$) compared with those in the animated condition. Attitudes toward the advertisement also were higher in the rotoscoped and live-action conditions compared with those in the animated condition, partly because of higher identification with the character (rotoscoped: ab = 0.27, *SE* = 0.07, $p < .001$; live action: ab = 0.24, *SE* = 0.07, $p < .001$), higher positive affect toward the character (rotoscope: ab = 0.16, *SE* = 0.06, $p = .012$; live action: ab = 0.21, *SE* = 0.07, $p = .001$), and lower perceived character eeriness (ab = 0.24, *SE* = 0.06, $p < .001$; live action: ab = 0.38, *SE* = 0.08, $p < .001$). Finally, attitudes toward the product were higher after seeing the rotoscoped and live-action advertisements versus the animated advertisement, partly because identification with the character was higher (rotoscoped: ab = 0.26, *SE* = 0.06, $p < .001$; live action: ab = 0.23, *SE* = 0.06, $p < .001$), positive affect toward the character was higher (rotoscoped: ab = 0.18, *SE* = 0.07, $p = .011$; live action: ab = 0.23, *SE* = 0.07, $p < .001$), and negative affect toward the character was lower (rotoscoped: ab = 0.10, *SE* = 0.04, $p = .010$; live action: ab = 0.11, *SE* = 0.04, $p = .006$).

<c>Chronic Dry Eye. The fit indices for the path model in the chronic dry eye sample indicated adequate fit, with an RMSEA = 0.10, SRMR = 0.06, TLI = 0.89, and CFI = 0.97. The authors have presented the covariance matrix (See Table A3 in the Appendix). Examining the direct paths, the authors found that those in both the rotoscoped and live-action conditions reported higher identification with the character ($B_{Rotoscoped} = 0.66$, *SE* = 0.19, $p = .001$; $B_{Live\ action} = 0.83$, *SE* = 0.18, $p < .001$) and lower perceived character eeriness ($B_{Rotoscoped} = -1.00$, *SE* = 0.22, $p < .001$; $B_{Live\ action} = -1.48$, *SE* = 0.20, $p < .001$) than those in the animated condition. Only the live-action condition, however, produced higher positive affect ($B_{Live\ action} = 0.57$, *SE* = 0.19, $p = .003$) and lower negative affect toward the character ($B_{Live\ action} = -0.19$, *SE* = 0.06, $p = .001$) compared with the animated condition.

The authors also observed significant associations between the mediator variables and attitudinal outcomes. Namely, identification with the character was positively associated with attitudes toward the character, advertisement, and product ($B_{Product} = 0.23$, *SE* = 0.05, $p < .001$; $B_{Advertisement} = 0.19$, *SE* = 0.04, $p < .001$; $B_{Character} = 0.28$, *SE* = 0.04, $p < .001$), as was positive affect toward the

Attitudes toward the product were more positive in the rotoscoped and live-action conditions compared with the animated condition, partly because of higher identification with the character after seeing the rotoscoped and live-action advertisements.

character ($B_{Product}$ = 0.35, *SE* = 0.04, $p < .001$; $B_{Advertisement}$ = 0.24, *SE* = 0.04, $p < .001$; $B_{Character}$ = 0.22, *SE* = 0.04, $p < .001$). Negative affect toward the character was negatively associated with attitude toward the character and product ($B_{Character}$ = −0.27, *SE* = 0.12, $p = .021$; $B_{Product}$ = −0.73, *SE* = 0.12, $p < .001$). Perceived eeriness also was negatively related to attitude toward the character and advertisement ($B_{Character}$ = −0.27, *SE* = 0.03, $p < .001$; $B_{Advertisement}$ = −0.18, *SE* = 0.04, $p < .000$). Surprisingly, higher perceptions of character eeriness were related to more positive attitudes toward the product (B = 0.10, *SE* = 0.04, $p = .003$). To determine whether this positive relationship was an artifact of the model, the authors restricted the path between perceived eeriness and attitude toward the product to zero. The model estimates did not change when this relationship was absent (*i.e.*, zero), indicating that the unexpected result was indeed an artifact of the model. Given this result, the authors did not interpret the indirect effects involving the pathway between experimental condition, perceived character eeriness, and attitude toward the product.

Path analysis results for the chronic dry eye sample also demonstrated significant indirect effects of animation strategy on attitudinal outcomes through several mediators. Compared with those in the animated condition, those in the rotoscoped and live-action conditions reported more positive attitudes toward the character, partly because of their higher identification with the character (rotoscoped: ab = 0.18, *SE* = 0.07, $p = .005$; live action: ab = 0.23, *SE* = 0.07, $p = .001$) and lower perceived character eeriness (rotoscoped: ab = 0.27, *SE* = 0.07, $p < .001$; live action: ab = 0.40, *SE* = 0.08, $p < .001$). Additionally, higher positive affect toward the character contributed to more positive attitudes toward the character among those in the live-action condition (ab = 0.13, *SE* = 0.05, $p = .015$). Attitude toward the advertisement also was higher after seeing the rotoscoped and live-action advertisements than the animated advertisement, partly because of higher identification with the character (rotoscoped: ab = 0.13, *SE* = 0.05, $p = .007$; live action: ab = 0.16, *SE* = 0.05, $p = .003$) and lower perceived character eeriness (rotoscoped: ab = 0.18, *SE* = 0.06, $p = .003$; live action: ab = 0.26, *SE* = 0.08, $p = .001$). Higher positive affect toward the character (ab = 0.14, *SE* = 0.06, $p = .012$) also contributed to more positive attitudes toward the advertisement among those who saw the live-action advertisements versus animated advertisements. Finally, attitudes toward the product were more positive in the rotoscoped and live-action conditions compared with the animated condition, partly because of higher identification with the character after seeing the rotoscoped and live-action advertisements (rotoscoped: ab = 0.15, *SE* = 0.06, $p = .005$; live action: ab = 0.19, *SE* = 0.06, $p = .001$). Higher positive affect toward the character (ab = 0.20, *SE* = 0.07, $p = .005$) and lower negative affect toward the character (ab = 0.14, *SE* = 0.05, $p = .005$) also helped to explain the more positive attitudes toward the product among those in the live-action condition versus animated condition.

DISCUSSION

This study was the first of its kind to test experimentally the effects of animation versus both live action and rotoscoping on recall, comprehension, risk and benefit perceptions, and behavioral intentions. The large sample size allowed for significant power to detect effects, and replication in two populations (individuals with psoriasis and individuals with chronic dry eye) reduced the likelihood that results were specific to one medical condition or one advertising execution.

The potential effects of the type of character on the study outcomes rested on the extent to which the animated characters could generate affective responses. The uncanny valley theory would suggest that rotoscoped characters may trigger disruptions to encoding and processing/comprehension of information in the advertisement, relative to the live-action advertisement, on the basis of their eeriness. The authors thus expected that memory and comprehension would likely be highest among the group that viewed the live-action advertisement. The study did not find an effect of the type of character on memory, however, as neither retention of risk nor retention of benefit information was affected by the character manipulation. This was surprising, given previous research (Pashupati, 2009; Shah *et al.*, 2019). Unlike Shah *et al.* (2019), however, who varied the presence of the rotoscoped character (*e.g.*, during the risk, during the benefit statement of the advertisement, or not at all) and found effects on both memory and perceptions of the product, the rotoscoped and nonhuman animated characters in this study were featured throughout the advertisement. It is possible that different mechanisms occur

depending on whether a character is featured at certain points in the advertisement, potentially distracting the viewer, or featured consistently throughout the advertisement, contributing to a response that is more general.

In terms of character perceptions, among the psoriasis sample, the authors found that those exposed to the rotoscoped and live-action advertisements reported lower character eeriness, higher identification, less negative affect, and more positive affect than those exposed to the animated advertisement. Among those in the chronic dry eye sample, viewers exposed to the rotoscoped and live-action advertisements reported lower eeriness and higher identification with the character than those who viewed the animated advertisement. In general, consumers viewed the rotoscoped and live-action characters similarly in terms of their identification and their positive and negative emotions; however, consumers did perceive the rotoscoped character as eerier than the live-action character.

In general, consumers viewed the rotoscoped and live-action characters similarly in terms of their identification and their positive and negative emotions; however, consumers did perceive the rotoscoped character as eerier than the live-action character.

These affective responses to the rotoscoped character (other than perceived eeriness) were not completely consistent with the uncanny valley theory, as the rotoscoped characters triggered responses that were similar to those to the live-action character. It is possible that earlier findings regarding rotoscoping reflected crude applications of the technique and that modern technology has rendered rotoscoping less unnatural. It is also possible that consumers have become familiar with the technique such that characters no longer seem unusual. A future study may experiment with different rotoscoped characters to examine the uncanny valley theory and determine whether they would trigger different reactions.

The affective responses to the animated characters were in line with some other studies that compared them with human characters. For example, Bhutadai *et al.*, (2017) conducted an experiment comparing photographed advertisements with animated spokescharacters in print direct-to-consumer advertising of prescription drugs and found more favorable attitudes toward the human spokescharacters. Additionally, audiences have rated films with cartoon characters as less likeable than films with characters that are live action or semirealistic, *i.e.*, animations that are highly humanlike (Kätsyri *et al.*, 2017).

Findings of positivity regarding animated characters seem to be prevalent in older studies, whereas more recent studies report negative reactions to animated characters. It is possible that consumers have become more cynical regarding advertising techniques. Although there has been interest in general consumer cynicism (Helm, Moulard, and Richins, 2015), future research in this area should further explore consumer cynicism as it relates specifically to animation in advertisements. Finally, the study's animated characters were nonhuman. The authors based this selection on the prevalence of existing advertisements for prescription drugs such as Mucinex, Lamisil, and Xifaxan, which used similar characters. The authors do not know the extent to which results would vary if they used a human animated character; therefore, they cannot completely rule out the possibility that the specific animated or rotoscoped execution of advertisements in this study may have influenced the attitude and perceptions related to these characters. Future research may explore the use of animated characters by executing various rotoscoping techniques or human and nonhuman animated characters.

On the basis of the affect heuristic, consumers' perceived character identification, perceived eeriness, and positive and negative emotions could transfer to their perceptions about the advertised product. The findings are consistent with the affect heuristic. The exploratory analyses examining potential mediators of the relationship between type of animation and attitudes toward the character, advertisement, and product suggested that character perceptions play a role in shaping these attitudes. Consistently, across both psoriasis and chronic dry eye samples, identification with the character mediated the effects of type of animation on all three attitudes, such that lower identification with the animated character explained, in part, the negative impact of the animated advertisement on attitudes. Positive affect toward the live-action character versus the animated character was also important in explaining participants' attitude toward the character, advertisement, and product. The findings align with explanations of how identification affects an audience's stance toward a message (Cohen, 2001; Fiske, 2001), whereby viewers did not identify with the animated character as much as the live-action and rotoscoped characters and, subsequently, took a more critical attitude toward the promotion.

In addition to these positively valanced mediators, the authors' findings indicated that negatively valanced reactions, specifically perceived character eeriness and negative affect toward the character, played mediating roles. Thinking that the animated character was eerie was associated with less positive attitudes toward that character and advertisement, and having other negative affects about the animated character, including disgust, discomfort, and fear, was associated with less positive attitudes toward the product. Overall, these findings support the affect heuristic in that the negative or positive affect toward the character is likely transferred to other dimensions such as attitudes toward the advertisement and the product.

Knowing, then, that animated advertisements result in less positive feelings and less favorable attitudes, and that positive attitudes can drive intentions to use a product (Fishbein and Ajzen, 2010; Spears and Singh, 2004), why would any drug marketer use animated advertisements? It may be that the long-term effects on recall or brand recognition are large enough or strong enough to override any small immediate negative effects on attitudes, such as those found in this study. Research on negativity bias suggests that more negative information is better recalled (Ohira, Winton, and Oyama, 1998; Robinson-Riegler and Winton, 1996). The authors found that the animated advertisement always resulted in less positive attitudes than did the live-action or rotoscoped advertisements. Sometimes the rotoscoped advertisement also produced less positive attitudes than the live-action advertisement. It is possible that the advertisements featuring animated characters are recalled over time better than those with live-action or rotoscoped characters because of the less positive attitudes they induce. Thus, examining lagged effects is an important step for future research. Finally, Pashupati (2009) suggested that marketers might use animation to make their brand stand out among others. Future research could explore the extent to which pharmaceutical marketers use animated spokescharacters to advertise drugs that have more competitors in the market.

Limitations and Directions for Future Research

The online panel is a convenience sample and is, therefore, not representative of the populations of people with chronic dry eye or psoriasis. This is, of course, a limitation of opt-in panel samples in general. Results thus may not be generalizable beyond the online panel used in the study. This study was experimental and prioritized internal validity, however. Future research could explore perceptions of animation in different populations.

This study's animated condition involved a nonhuman animated character, as direct-to-consumer advertisements do contain nonhuman characters, and the authors wanted to represent this reality. Not all animated characters are created equal, however. One of the study's characters was fuzzy and cute, whereas the other was a large eyeball with a body. It is possible that some of the differences in the proposed outcomes between the two sample groups were a result of that difference. As a first pass at examining television animation, the study should be replicated in different medical conditions with different executions.

One limitation inherent to *post hoc* analyses is the possibility for type I error. Given that the path analyses represented an additional set of tests beyond those specified in the *a priori* hypothesis, the possibility for observing significant results by chance increased. The findings would need to be replicated in a new sample to make more robust claims about mediation. A second limitation of the mediation analysis is that the mediators and dependent variables were measured at the same time, *i.e.*, within the survey after stimuli exposure. The authors, therefore, cannot definitively claim causality between these variables on the basis of temporal order. As mentioned earlier, however, theory and experimental studies supported the presumption that reactions to advertising—including identification with the character, affect, and perceived eeriness—would precede attitudes (Fiske, 1989; Holbrook and Batra, 1987; Kätsyr *et al.*, 2017, Mori, McDorman, and Kageki, 2012; Yoo and Kim, 2001).

Implications for Practice

The results presented here suggest that animated advertisements can result in less positive attitudes than live-action advertisements, at least immediately. Negativity bias suggests that negative information may be better remembered over time (Ohira *et al.*, 1998; Robinson-Riegler and Winton, 1996). The advertisements in this study, nevertheless, did not have positive or negative effects on the recall, recognition, or perceptions of risks and benefits. The results of this study suggest that animation and rotoscoping, as executed in this research, are simply alternative ways to advertise prescription drug brands. For regulators and brand managers alike, however, future research could explore whether animated advertisements are recalled better over time or have any lagged effects on perceptions of risks or benefits. It will be important to study different executions of rotoscoping, as those that result in characters that are less like human actors and more like animated characters may have different effects on perceptions and other outcomes. Researchers and brand managers may also want to explore whether any negative attitudes toward the advertisements or characters end up fostering negative sentiment toward the products themselves, which would obviously be counter to the advertisers' objectives. JAR

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Appendix A

Figure A1 Main Characters in Each Advertisement Condition

Table A1. Summary of Path Analysis Direct and Indirect Effects

Sample	Independent Variable	Mediator	Direct Effect	Dependent Variable	Direct Effect	Indirect Effect
Psoriasis	Experimental condition*	Identification with the character	✓	Attitude toward the character	✓	✓
				Attitude toward the advertisement	✓	✓
				Attitude toward the product	✓	✓
		Perceived eeriness of the character	✓	Attitude toward the character	✓	✓
				Attitude toward the advertisement	✓	✓
				Attitude toward the product	×	×
		Positive emotions toward the character	✓	Attitude toward the character	✓	✓
				Attitude toward the advertisement	✓	✓
				Attitude toward the product	✓	✓
		Negative emotions toward the character	✓	Attitude toward the character	✓	×
				Attitude toward the advertisement	×	×
				Attitude toward the product	✓	✓
Chronic dry eye	Experimental condition*	Identification with the character	✓	Attitude toward the character	✓	✓
				Attitude toward the advertisement	✓	✓
				Attitude toward the product	✓	✓
		Perceived eeriness of the character	✓	Attitude toward the character	✓	✓
				Attitude toward the advertisement	✓	✓
				Attitude toward the product	✓	✓
		Positive emotions toward the character	✓, ×	Attitude toward the character	✓	✓, ×
				Attitude toward the advertisement	✓	✓, ×
				Attitude toward the product	✓	✓, ×
		Negative emotions toward the character	✓, ×	Attitude toward the character	✓	×
				Attitude toward the advertisement	×	×
				Attitude toward the product	✓	✓

Note: ✓ indicates significant effect, and × indicates nonsignificant effect. *One symbol present in the cell (e.g., only × is present or only ✓ is present) indicates that the effect of the experimental condition is the same when comparing the live-action versus animated or the rotoscoped versus animated condition. Two symbols present in the cell (i.e., ✓ and × are both present) indicates that the effect of experimental condition comparing the live-action versus animated condition is significant but that the effect of the experimental condition comparing the rotoscoped versus animated condition is not significant.

Table A2. Covariance Matrix—Psoriasis

Variable	Perceived Eeriness	Identification with the Character	Positive Emotions toward the Character	Negative Emotions toward the Character	Attitude toward the Product	Attitude toward the Advertisement	Attitude toward the Character	Live-Action Condition	Rotoscope Condition
Perceived eeriness	0.593								
Identification with the character	−0.300	3.300							
Positive emotions toward the character	−0.146	2.149	2.994						
Negative emotions toward the character	0.675	−0.245	−0.053	2.277					
Attitude toward the product	−0.124	1.519	1.485	−0.272	1.974				
Attitude toward the advertisement	−0.457	1.666	1.512	−0.571	1.187	2.304			
Attitude toward the character	−0.541	1.916	1.601	−0.685	1.226	1.713	2.564		
Live-action condition	−0.122	0.096	0.103	−0.109	0.035	0.205	0.193	0.216	
Rotoscope condition	−0.030	0.127	0.048	−0.084	0.052	0.028	0.129	−0.097	0.212

Note: The diagonal elements of the matrix contain the variances of the variables, and the off-diagonal elements contain the covariances between all possible pairs of variables.

Table A3. Covariance Matrix—Chronic Dry Eye

Variable	Perceived Eeriness	Identification with the Character	Positive Emotions toward the Character	Negative Emotions toward the Character	Attitude toward the Product	Attitude toward the Advertisement	Attitude toward the Character	Live-Action Condition	Rotoscope Condition
Perceived eeriness	3.660								
Identification with the character	−0.805	2.979							
Positive emotions toward the character	−0.554	2.015	3.176						
Negative emotions toward the character	0.594	−0.205	−0.066	0.304					
Attitude toward the product	−0.430	1.439	1.549	−0.230	2.300				
Attitude toward the advertisement	−1.030	1.233	1.264	−0.210	1.184	2.185			
Attitude toward the character	−1.492	1.551	1.438	−0.313	1.131	1.520	2.470		
Live-action condition	−0.227	0.116	0.086	−0.029	0.072	0.172	0.204	0.228	
Rotoscope condition	−0.051	0.050	0.023	−0.007	0.025	−0.023	0.039	−0.111	0.216

Note: The diagonal elements of the matrix contain the variances of the variables, and the off-diagonal elements contain the covariances between all possible pairs of variables.