The role of facial expression in resisting enjoyable advertisements

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Chapter 5

Consumer Resistance through Shared Emotion Regulation

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Abstract

Consumers often watch amusing advertisements in company, and can be expected to mimic each other, modulating individual emotion expressions. We investigated effects of mimicry of facial expression on emotion and attitudes, using avatars as co-viewers. Three studies using self-report (n=139), automated facial coding (n=156) and eyetracking (n=117) demonstrated that ad-incompatible mimicry decreased consumers’ experience and expression of happiness, which in turn had negative impact on their attitudes and intentions. We propose that advertisement effectiveness diminishes when ads are watched in the company of others who dislike the ad or at least show expressions incompatible with the ad’s intended emotional response.
Introduction

Consumers tend to respond to the emotions of others by mimicking their emotional responses (e.g., Howard & Gengler, 2001). Although many studies have demonstrated various enhancing effects of mimicry on aspects of consumer behavior (e.g., Tanner, Ferraro, Chartrand, Bettman, & van Baaren, 2008) no studies have yet examined how exposure to another person’s emotional expressions while watching an advertisement may alter one’s own responses toward the ad. This omission is surprising when one realizes that people watch television, and thus advertisements, often in the company of family and friends. The social context, in which consumers watch TV commercials, may therefore play an important role in how advertisements and advertised products are evaluated. In the present research, we therefore examine whether the emotional expression of another person that hinders or facilitates the consumer’s initial expressions and subjective emotions toward the ad affects consumer’s attitudes and intentions. We will focus particularly on the facial expression of others because the face is an exceptionally rich source of affective information. Humans are capable of forming over 10,000 possible facial movement combinations (Ekman & Rosenberg, 1997) and so the face is an easily accessible barometer of emotion (e.g., Carroll & Russell, 1996).

To our knowledge, this study is the first to scientifically investigate advertising effects and psychological mechanisms behind so-called sync-watching (first coined by Giridharadas, 2014) an advertisement together. This happens when people are watching video stimuli (TV programs, TV series or movies) together by videocalling each other, for example through Skype or FaceTime (NY Times; Vance, 2010; Giridharadas, 2014). This is especially appealing to couples and friends who are physically far away (e.g., in different countries). For example, Hulu.com, the online streaming TV site, (with revenue of almost $700 million in 2012) has experimented with such real-time videocalling to watch content together but has not made it available yet (Vance, 2010).

To examine our research question we developed a new paradigm to study the effects of facial mimicry in such a sync-watching set-up. Based on actual human responses toward an amusing advertisement, we created an elaborate set of avatars, which are embedded in the advertisement. They functioned as 3-dimensional digital representations of another person who was watching the ad together with the targeted consumer (See Figure 1 and Appendix A).

In this paper, we identify theoretical reasons to use avatars instead of real people but we want to highlight here that our choice is also relevant to advertising practitioners. This relevance is due to the increasing prevalence of “avatarization” of a person while videocalling. For example,
ooVoo LLC, a social video communication platform with over 120 million registered users, showed a demo of Avatar Chat at CES 2015. This is an add-on to their ooVoo video chat that allows users to have their face represented as a virtual avatar. In addition, ooVoo has recently collaborated with Affectiva Inc. (an MIT spinoff with $20 million series B financing), and can now map people’s facial expression of emotion to their avatars in real time. So the person is “transformed” into a virtual and “expressive” avatar and such an avatar, who instead of the actual person behind the screen, can sync-watch a video with another person. As of now, we can only speculate about people’s motivation of to use avatars but this could be due, for example, to just having extra fun, sync-watch with strangers, or imposter someone else.

To highlight to the nonverbal communication and facial mimicking process behind sync-watching, imagine a couple watching an amusing TV commercial (during an advertisement break of their favorite TV series) that makes them both smile. This mutual smiling may facilitate and increase the couple’s facial expressions and emotional experience. If, however, the wife conspicuously shows disgust at the amusing advertisement, her incompatible facial expressions will probably hinder the husband’s initial positive expression (i.e., smiling) resulting in decreased expressions of happiness. Since people often use bodily feedback for evaluations and decision-making, the reduced expression of happiness might subsequently have a negative effect on attitudes toward the advertisement and the advertised product. We test the plausibility this process in this paper.

To our knowledge, no study has yet addressed this phenomenon, so a precise research set-up of such shared video watching through video-calling is unknown. However, the design of the studies in this paper is comparable, with the person watching the target stimulus (e.g., a video) presented in one portion of the screen while the face of the person’s companion is clearly visible in another (see Figure 1).

Across three experiments, we show that facial mimicry has effects on consumers’ emotion of happiness, intentions and attitudes. Specifically, we found that an avatar’s hindering (that is ad-incompatible) expression of disgust led to a reduction in the participants’ subjective experience (Study 1) and actual facial expression of happiness (Studies 2 and 3). In turn, this reduction of happiness and its expression resulted in lowered purchase intention and less positive attitudes toward the ad and advertised brand. We did not find any effects of an avatar’s facilitating (i.e., ad-compatible) expression, presumably due to a ceiling effect.

Facial Feedback
In a consumer context, it has been demonstrated that facial expression in response to an advertisement predicts attitudes toward the advertisement, as well as the brand (Lewinski, Fransen, & Tan, 2014b). More specifically, it was shown that when people smile (i.e., show facial expressions of happiness) while exposed to an amusing advertisement they like the ad and the brand more. These results can be explained by the notion of embodiment: the idea that feelings, thoughts, and behaviors are grounded in sensory experiences and bodily states (for a review, see Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005). For example, activity of the zygomaticus major muscle (smiling) is associated with happiness (Wu, Winkler, Andreatta, Hajcka, & Pauli, 2012), while that of the corrugator supercillii muscle (frowning) is associated with negative emotions (Alam, Barrett, Hodapp, & Arndt, 2008).

In a highly influential experiment, Strack, Fritz, and Stepper (1988) showed that putting a pen in someone’s mouth in a way that causes the facial muscles to contract and thus facilitates (hinders) smiling, increased (decreased) the intensity of humor responses. Larsen, Kasimatis, and Frey (1992) further demonstrated that unobtrusively making participants show a prototypical expression of anger resulted in more negative attitudes toward a stimulus. Bodily feedback from facial expressions thus shapes emotional experiences (see also McIntosh, 1996), modifies intensity of humor responses, and increases feelings of sadness.

Although facial expression of emotion often occurs automatically and unconsciously, recent research revealed that facial expression can be controlled by willful acts. In studies within the emotion regulation paradigm (Gross & Levenson, 1997; Richards & Gross, 2000) it has proven possible to manipulate facial expression through direct instructions. In particular, instructing consumers to exaggerate or to inhibit their facial expression while watching amusing stimuli resulted in more or less expressions of happiness respectively (Lewinski, Fransen, Tan, Snijdewind, Weeda, & Czarna, 2014c). Interestingly, attitudes toward the stimuli changed in correspondence with the expressions; when people were instructed to exaggerate their facial expression when exposed to the amusing stimulus they liked the stimulus more but when they were instructed to inhibit their facial expression they liked the stimulus less. The finding that a change in facial expression leads to a change in a person’s level of positive (negative) attitudes is consistent with the facial feedback hypothesis (Buck, 1980), which postulates that objective facial muscle movement feeds back into subjective emotional experience.

Taken together, it seems possible to influence people’s (initial facial) expression when exposed to various stimuli. Through the process of bodily feedback, this may also affect evaluations
and behavior. Going back to the example of the couple, we argue that others’ facial expressions of emotions might also influence A) the emotions felt and expressed by the target and B) subsequent attitudes and behavioral intentions. We propose this happens because people are automatically inclined to mimic the emotions of others (see below), which, depending on the expressed emotions of others might facilitate or hinder the viewer’s initial facial expression.

**Mimicry**

Mimicry can be defined as “exposure to the expressive displays of a conspecific [that] influences subjective emotional reactions via modulation of a subject's own expressive displays” (Bush et al., 1989, p. 32). In most consumer research the definition of mimicry as an influence factor is not clearly articulated. Mimicry is often operationalized as mere imitation but mimicry entails more than that. Imitation presupposes that the expression of an observer is identical to that of a model. However, an expression being identical is only one possible outcome of mimicry. In Bush et al.’s definition it is not the outcome but the ongoing process that sets mimicry apart as involving modulation of expression. Modulation entails changes in the pattern of facial expressions of the observer toward greater similarity to the model’s expression. Depending on the observer’s initial expression, the outcome of the modulation is an expression somewhere in between the initial muscular pattern and that exhibited by the model. When using the term mimicry we refer to this definition throughout the text and this means that, we do not assume a one to one mimicry outcome.

Mimicry is an activity that takes place spontaneously and involuntarily in specific craniofacial muscles of one individual when viewing similar actions in the face of another. Emotional expression, as perceived by the observer, activates the observer’s facial muscles (e.g., measured by facial electromyography) in correspondence with the perceived emotion (Dimberg, 1982; Lundqvist, 1995). Facial mimicking occurs fast - within 300 milliseconds after presenting the stimulus (Dimberg, Thunberg & Grunedal, 2002). Facial mimicry is affected by context (Vrana & Gross, 2004; Bourgeois & Hess, 2008), task (Lanzetta & Englis, 1989), and stimulus type (McIntosh, 2006). Mimicry may help in understanding others’ emotions, mental states, and can foster empathy (Gallese, 2005; Goldman & Sripada, 2005; Niedenthal, 2007).

Mimicking serves a social function. It tends to affect attitudes toward others. People like each other more when they mirror each other’s behavior, and the resultant mutual liking fosters development of relationships (for review see Lakin, Jefferis, Cheng, & Chartrand, 2003). In a consumer context, van Baaren, Holland, Steenaert, and van Knippenberg (2003) found that when staff members mimic their customers, they receive larger tips. Wang (2009) found that in a retail
service context, the emotions displayed by personnel influence consumer emotions, customer satisfaction, and brand attitudes.

Hypotheses

Since advertisement viewing often occurs in company of others, it can be assumed that the emotions of one person may be influenced by mimicking expressions exhibited by others. In the present research, we examine whether mimicry can affect attitudes on the assumption that one person’s facial expression is mimicked by another. The default response to someone else’s expression is mimicry, as this phenomenon has been shown to involve automated and autonomous responses. If the ad that two people are watching is amusing, one person’s happy expression may facilitate the happy expression of the other; whereas one person’s disgusted expression will hinder the expression of happiness by the other.

Watching an ad in the presence of another is expected to result in mimicry. Given that the ad is amusing, in ad-compatible mimicry, the consumer is exposed to an avatar’s expression in line with the ad’s intended emotional experience and facial expression, facilitating the consumer’s subjective feeling of happiness and its regular expression. Because the expression of disgust, due to the anatomy of the facial musculature, is antagonistic to expression of happiness (see e.g., EMFACS-7, Friesen & Ekman, 1983), the reverse will happen in ad-incompatible mimicry. In ad-incompatible mimicry, the targeted consumer is exposed to an avatar’s facial expression of disgust, hindering the targeted happiness and its facial expression. Our hypothesis stems partially from the assumptions of Raghunathan and Corfman’s model (2006) that “congruency of opinions enhances and incongruence of opinions diminishes the enjoyment of the shared experience (p.386).”

Moreover, we argue that the consumer’s facial expression resulting from mimicry will affect attitudes through an extended facial feedback process. More specifically, we predict that given an amusing ad, compatible mimicry increases consumers’ positive attitudes and intentions by facilitating consumers’ facial expression of happiness. In contrast, incompatible mimicry should decrease the consumers’ positive attitudes and intentions by hindering the consumer’s expression of happiness.

Overview of Experimental Studies

In three experiments, we simulated another person’s facial expression through the facial expression of an avatar added to a video advertisement. We assessed whether the targeted consumer mimicked the avatar’s emotional expression and whether the mimicry influenced the consumer’s attitudes. The factor that we manipulate in the reported studies, through altering the avatar’s facial
expression, is the compatibility of facial mimicry with emotions and expressions targeted by the ad. The default response to amusing ads is feeling happiness and expressing it by smiling and laughing (Lewinski et al., 2014b).

In Study 1, we manipulated consumers’ facial mimicry through changing the expression of the avatar, which was embedded in an amusing ad. Self-reported experienced happiness was measured as a check on the manipulation of mimicry. Dependent variables were attitudes regarding the ad, and purchase intention toward the advertised product. In Study 2, rather than measuring emotional self-reported experiences, actual facial expressions of emotion were measured using objective facial coding software. Study 3 aimed to replicate the findings of Study 2 and to explore possible influences of attention on the dependent variables, through eye-tracking data.

Study 1

In the current study, we set out to test a mediation model in which mimicry manipulated through the avatar’s facial expression manifests as a decrease or increase in consumers’ self-reported happiness. In turn, self-reported happiness should act as a mediator and result in lower or higher attitude scores for the advertisement, brand or buying the product.

Design and Procedure

We recruited participants from Amazon’s cloud-based workforce, Mechanical Turk (MTurk; Buhrmester, Kwang, & Gosling, 2011). Before taking part in the study, they signed an informed consent form. We redirected the participants who agreed to the Qualtrics platform, where we conducted the experiment. After answering demographical questions, participants were asked to watch an amusing video and they were randomly assigned to one of only four conditions (facilitating / hindering / no expression / control). After watching the advertisement, they responded to questions concerning the advertisement and the brand and they self reported their emotions by means of a questionnaire.

Note that we did not provide instructions as how to behave when watching the ad. In all conditions there were two control questions checking whether participants cheated or answered randomly. For example, “This is a control question please mark 3 because otherwise the survey will stop.” If a participant did not answer the two control questions correctly, we automatically terminated the experiment and discarded the participant’s scores. This explains why, below, we report unequal samples, even though we randomized the condition assignment.
Participants. Our sample consisted of 139 participants (Men = 84, Women = 55, mean age = 35.71; SD = 12.47): 39 in the facilitating expression, 37 in the hindering expression, 34 in the no expression, and 29 in the control condition. Participants came from a population of U.S. residents 18 years of age or older. We expected participants to spend no more than 15 minutes on the experiment and paid them $0.85 each. We decided ex ante to collect as many observations as we could in three days.

Mimicry Ad-compatibility Through an Avatar’s Expression

We showed participants the same advertisement in the four different conditions. The ad was an amusing (30-seconds) TV commercial of Doritos chips (Doritos Goat for Sale Ad) - that was pre-tested: $M$ amused = 5.91, $SD$ = 1.30 on a 7-point Likert scale, $n$ =11. In the facilitating expression condition we presented a smiling avatar (ad-compatible mimicry). The hindering expression condition presented a disgusted avatar (ad-incompatible mimicry). The no expression condition contained an unexpressive avatar while the control condition featured no avatar at all. We included an avatar that did not react, remained motionless throughout and did not show any expression, on the presumption that it would enable at most minimal mimicry and have either weak negative or no effect on attitudes. We adopted the no-avatar control condition to check the notion that there cannot be mimicry without exposure to a facial expression and therefore no effects on attitudes.

For our facilitating and hindering conditions, we created an elaborate set of animated avatars based on previously gathered real people’s generalized expression of happiness over the course of the same advertisement. Exposure to the hindering, facilitating or unexpressive avatar was implemented by an insert in the right-bottom corner of the screen of the Doritos advertisement. Figure 1 visualizes the stimuli and the Web Appendix provides an example of the video advertisement with the disgusted avatar.

Appendix A describes the avatar production process in detail. It demonstrates that the avatar’s expression corresponds to a quantified script following the actual course of expressions of happiness of previous viewers of the particular ad, under normal conditions. We provide this detailed description to demonstrate that our stimuli shows generalized, i.e., prototypical, facial expression of either happiness or disgust in response to our particular advertisement (the Doritos Ad). The avatar was made to look unaware of the consumer and to receive no feedback from the consumer. It acted according to a fixed script.

We used avatars rather than real people because it is difficult, to the point of impossible, for human actors to properly time their disgusted or smiling facial expression during the ad’s display. It
is difficult for a human actor to decide when exactly to smile or show disgust with lower and higher intensity. The ideal facial expression score of the actor might be informed by the responses of a test audience. We found out that the ideal expression score for a target ad was much easier to implement by having an avatar reproduce the aggregated facial expression of a test audience in response to the ad.

![Figure 1. Advertisement with different mimicry conditions](image)

**Measures**

**Self-reported happiness.** We measured experienced self-reported happiness using a Likert scale ranging from (1) to (7): *Not present at all* – *Neutral* – *Extremely present*.

**Consumer intentions and attitudes.** We measured only purchase intention (PI), attitudes toward the brand (AB), attitudes toward the advertisement (AAD), following the Advertising Effectiveness Model (Mitchell & Olson, 1981). To measure purchase intention (PI) participants answered how much they agreed with the following four statements on 5-point semantic differential scales (*α* = .96): ‘Thinking back to the ad, the chance that I would buy brand – Doritos – is: *unlikely* – *likely; improbable* – *probable; uncertain* – *certain; absent* – *present* and with seven statements concerning the advertisement (*α* = .97) and the brand (*α* = .97) on a 7-point semantic differential scale: ‘I found the advertisement/the brand’: *bad* – *good; unappealing* – *appealing; unpleasant* – *pleasant; unattractive* – *attractive; unwise* – *wise; useless* – *useful; worthless* – *valuable*. The mean
scores on the ad attitude, brand attitude and purchase intention measures served as the dependent variables.

Results

To test the influence of the avatar’s expression on attitudes toward the ad, attitudes toward the brand and purchase intention, we used Preaches and Hayes’ method (2008) that estimates path coefficients in a mediator model. We generated 10,000 bootstrapped samples to estimate bias corrected and accelerated confidence intervals (BCACI). We tested the total and specific indirect effects of the expression conditions on attitude toward the advertisement, attitude toward the brand, and purchase intention through self-reported happiness. The variable differentiating participants in terms of expression condition was dummy-coded. This resulted in three independent coding schemes - (a) facilitating; (b) hindering; and (c) no expression condition - each coded versus all the other and the control condition. In all analyses, we included corresponding dummies as covariates.

The results showed that the hindering and no expression conditions decreased self-reported happiness, which predicted lower purchase intention and lower attitudes. We found no such results for the facilitating condition.

**Purchase intention.** The hindering expression condition negatively affected self-reported happiness ($b = -1.22; p < .005$). Self-reported happiness was positively related to purchase intention ($b = 0.42; p < .0001$). We found a negative indirect effect for purchase intention ($IE = -.51, SE = .17, 5\% BCACI [-0.8919, -0.2062]$) with a medium effect size ($K^2 = .10$, Preacher & Kelley, 2011). There was no direct effect of hindering expression on purchase intention ($b = 0.47; p = .08$). See Preacher and Hayes (2008) and Rucker, Preacher, Tormala, and Petty (2011) for discussion and approval of indirect effects without a significant total effect.

**Attitude toward the brand.** We found analogical results when testing attitude toward the brand as an outcome variable. The hindering expression predicted lower self-reported happiness ($b = -1.22; p < .005$) and so did the no expression condition ($b = -1.30; p < .005$). Self-reported happiness predicted scores on attitude toward the brand ($b = 0.50; p < .0001$). For both conditions, negative indirect effects appeared ($IE = -.60, SE = .21, 5\% BCACI [-1.0942, -0.2443]$, a medium effect size ($K^2 = .11$); $IE = -.64, SE = .21, 5\% BCACI [-1.1256, -0.2846]$, a medium effect size ($K^2 = .10$), respectively) with no direct effects found ($b = 0.29, p = .32; b = 0.11, p = .71$, respectively).

**Attitude toward the advertisement.** As expected, the hindering and the no expression condition had a negative effect on self-reported happiness ($b = -1.22, p < .005; b = -1.30, p < .005$, respectively). Self-reported happiness predicted attitude toward the advertisement ($b = 0.67; p <$
.0001), which resulted in significant negative indirect effects (IE = -.81, SE = .26, 5% BCACI [-1.3893, -0.3334], a medium effect size (K^2 = .17); IE = -.88, SE = .27, 5% BCACI [-1.4250, -0.3815], and a medium effect size (K^2 = .15) (respectively). No direct effect of the hindering condition on attitudes toward the ad was found (b = -0.26; p = .30) whereas a direct negative effect of the no expression condition on attitude toward the ad appeared (b = -0.64; p < .05).

We found similar results for the no expression condition: it influenced negatively self-reported happiness (b = -1.30; p < .005), whereas self-reported happiness predicted purchase intention (b = 0.42; p < .0001), giving, as a result, negative indirect effects (IE = -.54, SE = .18, 5% BCACI [-0.9292, -0.2239]) with a medium effect size (K^2 = .10). There was no direct effect of the no expression condition on purchase intention (b = 0.30; p = .27).

For the mean scores of PI, AB, and AAD across all conditions, see Table 1. For a graphic representation of the mediator models with purchase intention (PI), see Figure 2 for visualization of the mediation model with the hindering avatar.

Table 1
Mean Scores of Purchase Intention, Attitude toward the Brand, Attitude toward the Advertisement, and Self-Reported Happiness across All Conditions in Study 1.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Facilitating expression (Study 1)</th>
<th>Hindering expression (Study 1)</th>
<th>No expression (Study 1)</th>
<th>Control (Study 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>39</td>
<td>37</td>
<td>34</td>
<td>29</td>
</tr>
<tr>
<td>PI*</td>
<td>3.73</td>
<td>3.55</td>
<td>3.36</td>
<td>3.59</td>
</tr>
<tr>
<td>SD</td>
<td>1.25</td>
<td>1.26</td>
<td>1.28</td>
<td>1.20</td>
</tr>
<tr>
<td>AB*</td>
<td>5.07</td>
<td>5.03</td>
<td>4.83</td>
<td>5.33</td>
</tr>
<tr>
<td>SD</td>
<td>1.57</td>
<td>1.54</td>
<td>1.49</td>
<td>1.04</td>
</tr>
<tr>
<td>AAD**</td>
<td>5.00</td>
<td>4.48</td>
<td>4.06</td>
<td>5.56</td>
</tr>
<tr>
<td>SD</td>
<td>1.29</td>
<td>1.65</td>
<td>1.89</td>
<td>1.06</td>
</tr>
<tr>
<td>SRH**</td>
<td>5.21</td>
<td>4.43</td>
<td>4.35</td>
<td>5.66</td>
</tr>
<tr>
<td>SD</td>
<td>1.54</td>
<td>1.98</td>
<td>1.88</td>
<td>1.17</td>
</tr>
</tbody>
</table>

Note. PI = purchase intention; AB = attitude toward brand; AAD = attitude toward advertisement; SRH = self-reported happiness. A one-way ANOVA was conducted to determine if the PI, AB, AAD or SRH was different for groups with different expression conditions. There was no statistically significant difference between means for PI and AB (*p > .50) but there was difference for AAD and SRH (**p < .05)
In the facilitating expression condition there was no indirect effect (the confidence intervals did not include zero, 5% BCACI [-0.4984, 0.0802]; [-0.5996, 0.0822]; [-0.7592, 0.1445]) nor direct effect ($p = .23; p = .82; p = .29$) respectively for PI, AB or AAD. The facilitating expression did not have any effect on facial expression of happiness ($b = -0.45; p = .28$).

**Discussion**

In Study 1, we found that exposure to a disgusted or unexpressive avatar with the amusing advertisement led to less experienced happiness. Furthermore, we found support for the ad-incompatible hypothesis, that is, the reduced feelings of happiness had a negative impact on consumer attitudes. As predicted, the unexpressive and disgusted avatar led to less happiness, so ad-incompatible mimicry occurred in these conditions. The effects of the unexpressive avatar were stronger than predicted perhaps exposure to its facial expression gives rise to more dampening of happiness than expected. When mimicked, the no expression may inhibit the target consumer’s expression of happiness as much as a disgust expression. Another explanation is an unpleasant effect of its stillness having a direct impact on feeling. A limitation of Study 1 is that self-reported happiness is not as valid a proxy for mimicry as actual facial expression is, and this is why the next study measures facial expression as an objective measure of facial mimicry.

**Study 2**

The second study examines the occurrence of mimicry by checking the consumer’s facial expression rather than subjective feeling. Ad-compatible mimicry, that is exposure to an avatar expressing happiness, was predicted to increase attitudes toward the advertisement, brand and
purchase intention. Conversely, ad-incompatible mimicry, exposure to an avatar expressing disgust, was expected to result in less facial expression of happiness and subsequently decrease in attitudes and intentions.

**Design and Procedure**

In Study 2, we followed the experimental setup of Study 1. We randomly assigned participants to one of only four conditions: exposure to ad-incompatible, ad-compatible mimicry (hindering vs. facilitating expression), no mimicry, or a no exposure control condition. The only difference was that in Study 2, we video-recorded participants’ facial expression and we asked them to fill out a questionnaire about their emotion expressiveness (see below). We used a more objective measure of emotions by recording participants’ facial expression, using their own web cameras. The video material was coded by FaceReader (Noldus, 2014), which is automated facial expressions analysis software. We will describe this measure in more detail below.

Before taking part in the study, participants signed an informed consent including information that they would be required to use their own webcams to record their faces. We redirected participants who agreed to an online platform (www.facereader-online.com) where we conducted the experiment. We provided the participants with uniform instructions for camera setup. We measured consumers’ attitudes with the same measures as used in Study 1. At the end, we asked participants how they perceived the avatar.

**Participants.** We included a fresh sample of 156 participants recruited through MTurk in the study (Men = 76, Women = 80, mean age = 31.54; SD = 11.44): 40 in the facilitating, 37 in the hindering, 40 in the no expression, and 39 in the control condition. See Appendix B for rules of exclusion, due to the poor quality of some of the facial video recordings. We decided to collect as many observations as we could in seven days.

**Measures**

**Facial expressions - FaceReader.** FaceReader (Noldus, 2014) is artificial neural network software that automatically analyzes facial expressions of emotion once a computer camera records them. We used FaceReader to measure emotion expressed by the participants. FaceReader proved to be a reliable and objective tool, which recognizes target emotion with 88-89% accuracy (see van Kuilenburg, Wiering and den Uyl, 2005) and happiness with 96% (Lewinski, den Uyl, & Butler, 2014a). In every frame of the recording, FaceReader shows the extent of a range of facial expressions of emotion (Ekman, 1972) of the participants. We used average scores of the top 10% peak values provided by FaceReader for every participant with a continuous calibration. It is a
validated measure for advertising research of happiness expression intensity, probability, and duration (see Lewinski et. al, 2014b for more details). For a visualization of a participant’s facial reactions to the advertisement, see the Web Appendix.

**Consumer attitudes and intentions.** For consumer’s purchase intention, attitude toward the brand and advertisement we use the same measures as in Study 1; purchase intention (α = .93); attitude toward the brand (α = .93); attitude toward the advertisement (α = .93).

**Emotion expressiveness.** To statistically control for individual differences in emotion expressiveness, that is regulation of emotional experience and management of the habitual use of expressions, we included the Emotion Regulation Questionnaire (ERQ) developed by Gross and John (2003). It assesses experience, i.e., cognitive reappraisal (α = 0.91, 6 items), with items like “I control my emotions by changing the way I think about the situation I’m in” and expressions, i.e., expressive inhibition (α = 0.82, 4 items), with questions such as “I control my emotions by not expressing them.” Aggregated responses are qualified as traits particular to an individual and we included them as covariates.

**Results**

We used the same Preaches and Hayes’ (2008) method and dummy coding as in Study 1. In all analyses, we included corresponding dummies as covariates. We controlled for the influences of both gender and emotion expressiveness through ERQ (Gross & John, 2003).

The results showed that only the avatar’s hindering expression decreased consumer’s facial expression of happiness. Hence, ad-incompatible mimicry was observed, whereas ad-compatible was not, while the no mimicry and no exposure control condition failed to produce mimicry as defined in this study. Ad-incompatible mimicry led to lower purchase intention and lower attitudes, while all other conditions did not. See below for the statistical analysis.

**Purchase intention.** The hindering expression did not have a direct effect on purchase intention (b = -0.04; p = .87). However, it had a marginally negative effect of facial expression of happiness (b = -0.16; p = .066), which decreased purchase intention (b = 0.67; p < .05). For purchase intention, we found a negative indirect effect (IE = -.07, SE = .06, 5% BCACI [-0.2609, -0.0002]), with a small effect size (K² = .02).

**Attitude toward the brand.** We found analogical results when testing attitude toward the brand as an outcome variable. The hindering expression predicted marginally less facial expression of happiness (b = -0.16; p = .066) and facial expression of happiness predicted attitude toward the
brand \((b = 0.64; p < .05; \text{IE} = .10, \text{SE} = .07, 5\% \text{ BCACI} [-0.3100, -0.0029], \text{with a small effect size (K}^2 = .03))\). A direct effect was not found \((b = -0.11; p = .68)\).

**Attitude toward the advertisement.** The hindering expression had a marginal negative effect on facial expression of happiness \((b = -0.16; p = .066)\) and it was positively related to attitude toward the advertisement \((b = 1.02; p < .005)\). This resulted in a significant negative indirect effect \((\text{IE} = -0.16, \text{SE} = .10, 5\% \text{ BCACI} [-0.4200, -0.0066])\) with a small effect size \((K^2 = .05)\). We found no direct effect, which means that it was ad-incompatible mimicry as a compound process rather than exposure to an avatar expressing disgust that influenced the attitude toward the advertisement \((b = -0.15; p = .61)\). For the mean scores of purchase intention, attitude toward the brand, and attitude toward the advertisement across all conditions see Table 2.

Table 2

*Mean Scores of Purchase Intention, Attitude toward the Brand, Attitude toward the Advertisement and Facial Expression of Happiness across All Conditions in Study 2*

<table>
<thead>
<tr>
<th>Measure</th>
<th>Facilitating expression (Study 2)</th>
<th>Hindering expression (Study 2)</th>
<th>No expression (Study 2)</th>
<th>Control (Study 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(n)</td>
<td>40</td>
<td>37</td>
<td>40</td>
<td>39</td>
</tr>
<tr>
<td>PI*</td>
<td>3.89</td>
<td>3.78</td>
<td>4.22</td>
<td>3.91</td>
</tr>
<tr>
<td>AB**</td>
<td>5.28</td>
<td>5.17</td>
<td>5.72</td>
<td>5.38</td>
</tr>
<tr>
<td>AAD*</td>
<td>5.14</td>
<td>4.93</td>
<td>5.25</td>
<td>5.25</td>
</tr>
<tr>
<td>FEH**</td>
<td>0.55</td>
<td>0.40</td>
<td>0.52</td>
<td>0.56</td>
</tr>
</tbody>
</table>

*Note.* PI = purchase intention; AB = attitude toward brand; AAD = attitude toward advertisement; FEH = amount of facial expression of happiness. A one-way ANOVA was conducted to determine if the PI, AB, AAD or FEH was different for groups with different expression conditions. There was no statistically significant difference between means (*p > .30, **p > .15*)

We found no such results for all other conditions. In the facilitating expression condition (i.e., ad-compatible mimicry) there was no indirect (5\% BCACI [-0.1085, 0.0717]; [-0.1282, 0.1032]; [-0.1923, 0.1562]) nor direct effect \((p = .96; p = .69; p = .77)\) respectively for purchase intention, attitude toward the brand and attitude toward the ad. The facilitating expression condition did not have any effect on facial expression of happiness \((b = -0.01; p = .91)\). In the no expression condition there was no indirect (5\% BCACI [-0.1462, 0.0529]; [-0.1624, 0.0845]; [-0.2392, 0.1331]), nor direct effect \((p = .13; p = .14; p = .82)\) respectively for purchase intention, attitude
toward the brand, and attitude toward the ad. The no expression condition did not have any effect on facial expression of happiness ($b = -0.03; p = .68$).

**Discussion**

We demonstrated that ad-incompatible facial mimicry manipulated through exposure to an avatar displaying disgust resulted in less expression of happiness, which subsequently resulted in lower purchase intention and attitudes. However, we did not observe ad-compatible mimicry; that is mimicry consisting of exposure to an avatar responding with a facial expression targeted by the ad (i.e., of happiness) and followed by the consumer’s liking response. It could be that the amusing advertisement had a ceiling effect on happiness and its facial expression, which could not be surpassed by watching this ad with a smiling person. Extended or sustained facial feedback then could not increase attitudes any more.

**Study 3**

In Study 3, we aim to replicate findings from Studies 1 and 2 testing only the most powerful effect, the hindering expression condition. Study 3 offers a conceptual replication of both previous studies in a controlled lab experiment with a European sample in contrast to an online sample of North American participants. In addition, in Study 3, the camera used for facial recordings was less conspicuous, presumably reducing possible self-awareness on the part of the participants.

An important limitation of both Studies 1 and 2 is that we did not control for the attention that consumers pay to the avatar. For mimicry to occur, at least some attention should be paid to the avatar. However, differences between the ad-incompatible condition (hindering expression) and the no exposure control condition on consumer responses should not be attributable to the fact that the avatar drew attention to itself while considerably reducing attention for the ad. The extent to which consumers paid attention to the avatar in Study 2 could only be estimated from consumers’ self-reports about attending to the avatar (see Appendix A, *Manipulation Check*). Self-report of attention is often unreliable and our manipulation check is no exception. To explore the amount of attention spent on the avatar vs. the ad, we used a direct behavioral measure enabled by eyetracking in Study 3.

**Design and Procedure**

We followed the experimental outline of Study 2 with a number of modifications. We randomly assigned participants to two conditions only: hindering and control. We did not include the two other conditions because the facilitating expression seemed to suffer from a ceiling effect in Studies 1-2. The no-expression control condition was not necessary to test the role of attention. In
addition to FaceReader, we used an eyetracker to measure attention. We again measured the same attitudes and intentions of consumers; purchase intention (α = .92); attitude toward the brand (α = .91); attitude toward the advertisement (α = .92).

**Participants.** We included a sample of 117 participants recruited through one large public university in the Netherlands (Men = 27, Women = 90, mean age = 22.31; SD = 4.73): 55 in the hindering expression, and 62 in the control condition. Participants agreed to informed consent, and were either paid €10 per hour or received credit points, and were debriefed at the end. We decided to collect as many observations as we could in a three-week period. See Appendix C for exclusion rules followed in this study, necessary due to the poor quality of some of the facial recordings.

**Measures**

**FaceReader.** We used the same software as in Study 2 to analyze participant’s facial expression when viewing the amusing commercial. However, the webcam that recorded participant’s facial expressions was hidden in the eyetracker and therefore we assume that participants were less aware and hence not potentially influenced by the presence of the webcam as could have been the case in Study 2.

**Attention – Tobii T120.** We used the Tobii 120 eye tracker and Tobii Studio software for experimental design, data collection and data analysis. We used these to measure and quantify attention to the advertisement and the avatar. Participants were positioned at around 25.6 inches from the 17-inch TFT monitor and we calibrated the eyetracker until a good calibration fit was achieved. Participants’ eye movements were recorded 120 times per second (120 Hz speed).

As a measure of attention to the advertisement, we took the total visit duration, the number of visits and total number of fixations within the advertisement screen area in both conditions. We used this area of interest because the only systematic difference between the conditions could have been due to the presence of the avatar to the side of the advertisement in the hindering expression condition. Total visit duration is a straightforward measure of how long participants were looking at the advertisement. Number of visits in an area of interest informs about changes in a participant’s attention because gaze shift is preceded by an attention disengagement (Wright & Wards, 2008). Total number of fixations is also called “fixation density” within a specific area and it is one of the most used metrics in usability research to define how much attention people paid to given stimuli (Jacob & Karn, 2003).

**Results**
We used the same Preaches and Hayes’ (2008) method as in Studies 1 and 2. In all analyses, we assigned 0 to the control condition and 1 to experimental condition (hindering expression).

**Consumers’ attitudes and intentions.** The results demonstrated that the hindering expression had a negative effect on facial expression of happiness \( (b = -.09, p = .04) \). Participants in the hindering expression showed less expression of happiness than participants in the control condition did. The hindering expression condition had no direct influence on purchase intention (PI) \( (b = 0.17, p = .38) \), attitude toward the brand (AB) \( (b = 0.53, p = .76) \) or the attitude toward the advertisement (AAD) \( (b = -0.11, p = .58) \). However, facial expression of happiness predicted PI \( (b = 1.26, p < .005) \), AB \( (b = 1.28, p < .001) \), AAD \( (b = 2.07, p < .0005) \) and contributed to a significant negative indirect effect in each case, PI - (IE = -.11, SE = .07, 5% BCACI [-0.2799, -0.106]), with a small effect size \( (K^2 = .06) \); AB - (IE = -.12, SE = .07, 5% BCACI [-0.2765, -.0115]), with a small effect size \( (K^2 = .06) \); AAD - (IE = -.19, SE = .10, 5% BCACI [-0.4031, -0.0198]), with a medium effect size \( (K^2 = .09) \) respectively.

**Attention.** To analyze attention, we included a sample of 57 participants: 27 in the hindering expression, and 30 in the control condition. Because we wanted to adhere to the highest standards on reporting the eye tracking data, we had to remove 60 participants from the original sample reported above who did not have their eye movement tracked for long enough. See Appendix D for the inclusion criteria and explanation.

An independent-samples t-test was run to identify differences in total visit duration, the number of visits and the total number of fixations on the advertisement screen area between the hindering expression and the control condition. Equal variances were not assumed. Participants spent less time (in seconds) on the ad in the hindering expression condition \( (M = 21.74, SD = 3.57) \) than in the control condition \( (M = 23.67, SD = 0.41) \), \( t(26.63) = -2.81, p = .009 \). Accordingly, participants made more visits to the ad area in the hindering expression \( (M = 5.56, SD = 3.34) \) than in the control condition \( (M = 1.23, SD = 0.77) \), \( t(28.51) = 6.56, p < .001 \). The increased visits are due to attention shifting back and forth between the ad and the avatar. The total number of fixations did not differ \( (p = .16) \) between the hindering expression \( (M = 51.85, SD = 12.51) \) and the control condition \( (M = 55.80, SD = 7.47) \). For a visualization of participants’ attention distribution, see Figure 3 and the Web Appendix.
To sum up, in Study 3, we demonstrated that ad-incompatible mimicry occurred and resulted in lower consumer’ attitudes. The control condition did not produce mimicry as predicted. The results of the attention measure indicated that people indeed looked at the avatar and were moving their eyes from one area of interest –namely the avatar- to another one, the ad video. Thus, we assume that the presence of the avatar could indeed affect their facial response to the ad but not significantly enough to distract them completely from the ad.

Study 3 was conducted in a controlled lab environment replicating the findings from our online studies. This adds evidence to the experimental rigor of the three studies. Further, in Study 3, we used a European sample. This helps to mitigate effects of culture-specific findings. This study had less between-group variance as compared to Studies 1-2 because Study 3 included only two conditions. Nevertheless, we still confirmed our mediation model.

**General Discussion**

In Study 1, we found that adding a disgusted or unexpressive avatar to an amusing advertisement led to less experienced happiness, which in turn had a negative impact on consumer attitudes and intentions. In this study, we asked participants what emotions they experienced after watching the commercial. Since recent findings in emotion research demonstrated that experienced emotions (i.e., self-reported emotions) do not always correspond to expressed emotions (see
summary of a special section in *Emotion Review*, Fernández-Dols, 2013), we included an objective measure of facial expression in Study 2. By recording and objectively coding consumer’s facial expression, we were able to demonstrate a direct link between expressed emotions, attitudes, and intentions. In other words, including this measure enabled us to provide more direct evidence for facial mimicry and the facial feedback hypothesis.

The results of Study 2 revealed that facial mimicry, manipulated through an avatar displaying disgust, led to less expression of happiness, which in turn led to lower purchase intentions and attitudes. As expected, we did not find an effect of the unexpressive avatar. The unexpressive avatar has no dynamic properties, which makes mimicking of movement impossible. In order for mimicry to occur, the expression must change as is demonstrated by Rymarczyk, Biele, Grabowska, and Majczynski (2011), people tend to mimic dynamic, but not still, facial expressions. Interestingly, when measuring self-reported emotions we do find an effect of the unexpressive avatar on feelings and attitudes (Study 1). Apparently, an unexpressive avatar does change consumer’s subjective feelings but not their facial expressions. This aligns with previous findings revealing that there is not always a high correlation between self-reported emotions and expressed emotions (Fernández-Dols, 2013).

In Study 3, we aimed to exclude the possibility that the avatar (independent of its expression) draws all attention away from the commercial and therefore affected emotions, attitudes and intentions. To do this, we included an eyetracker measure to demonstrate how participants divide their attention between the advertisement and the avatar. The results revealed that participants did not pay attention only to the avatar and they still spent a considerable amount of time visiting the ad. In the hindering expression condition, marginally less attention (1.93 seconds) was paid to the advertisement than in the control condition and in the total fixation time, no differences were observed.

Moreover, we demonstrated that the avatar attracted consumers’ attention sufficiently to change their emotional expression. Importantly, the alternative explanation of the mere presence of the avatar or simple distraction is ruled out. This adds support to the notion that consumers are not simply distracted or primed by the disgusted avatar and this is not why they expressed their emotions less. The heat-map with the visualization of participants’ eye movements (Figure 3 and Web Appendix) further demonstrates general patterns of their attention. It helps to show that the avatar’s hindering expression was perceived and attended to, which is a necessary condition for mimicry, and rules out peripheral vision, mere presence explanation of the effects.
Facial Feedback and Consumer Attitudes toward Ads

Our results align with previous work on facial expression and emotion regulation. There are two forms of emotion regulation relevant to our work: cognitive reappraisal (Richards & Gross, 2000), and expressive suppression (Gross & Levenson, 1997). As already mentioned in the introduction, it was found that experimentally manipulated cognitive reappraisal decreased facial expression of happiness. In turn, consumers’ positive attitudes toward an amusing advertisement or the brand also decreased. Expressive suppression and amplification led to less or more facial expression and, hence, to lower or higher positive attitudes (Lewinski et al., 2014c). Those findings are congruent with our present findings. In the present study, it seems that inhibitory emotion regulation (cognitive reappraisal or expressive suppression) due to incompatible mimicry either changes initial appraisal of the amusing stimuli, disrupts the feedback function of the consumers’ own facial expression, or likely does both simultaneously. Irrespective of the precise mechanism, reappraisal hinders consumer’s facial expression and so disrupts the facial feedback process. This depresses consequent attitudes and intentions. Emotion regulation by expressive suppression and amplification might hinder or facilitate a consumer’s facial expression, disrupting or enhancing facial feedback. This would change the consumers’ resultant attitudes and purchase intention toward the ad.

In contrast to previous research in which it was demonstrated that adding “fake” audience laughter tends to boost enjoyability ratings of radio recordings (Martin & Gray, 1996), we did not find effects of the smiling avatar condition (i.e., ad-compatible mimicry) in our studies. Participants who were exposed to an amusing commercial and perceived a smiling avatar did not show increased feelings of happiness (Study 1) and did not exhibit more expressions of happiness (Study 2). It could be that people do not feel the need to imitate when they notice that their expressed emotions are already similar to the emotions of others. Interestingly, this is in contrast to recent findings on enhancing effects of mimicry congruence in shared hedonic stimuli consumption (Raghunathan & Corfman, 2006).

Another possible explanation could be a ceiling effect; the smiling avatar did not produce a change in the participant’s expressed happiness or attitudes, as they were already very high. This could be ruled out in future research by using a moderately amusing commercial.

Avatarization of Sync-Watching Person

A drawback of our studies is that the question of which facial expression is mimicked - that of the avatar or that of the human actor in the ad - is left unanswered. Due to our rigorousness in
mapping facial expressions transferred from the general population to the avatar, we argue that our virtual avatar stimuli instill the facial mimicking process in consumers who watched it. The facial display patterns of the avatar are tailor-made and synchronized with responses to a specific Doritos Ad in this particular target population.

We believe that our findings extend beyond avatarization of a person who is watching the video together with another person through videocalling. We do believe that our avatars functioned roughly the same way that human models would have in our experimental conditions. Avatars are similar enough to people to generate emotional responses without being human beings (e.g., see Bailenson and Yee, 2005), minimizing the possible confounding effects of a mere human presence.

Limitations

However, the use of avatars rather than human models co-viewing the ads is a possible limitation to generalization of our results. For instance, it may be that human models evoke stronger mimicry responses than avatars (see research on mimicry influences in shared emotional experiences; Ramanathan and McGill, 2007). Further research comparing the two sources of facial expression can shed light on this possibility.

The expressions of the human actor were the same across experimental conditions but we do not know which of either expression is mimicked stronger, and what would be the mechanism behind it. To our knowledge, there is no study that has tested such a paradigm. Though Stel, Mastop, and Strick (2011) showed attitude and intention effects through mimicking of an actor presenting a product in an ad, they did not include any measure of behavioral mimicry (either as a mediator or as DV).

Another limitation of our studies is the relatively small $p$ values and effect sizes. However, we argue that our findings should be taken holistically and not individually. We find similar patterns of results across different conditions, measures and samples with the use of objective behavioral methods. It should be noted that effect sizes of $K^2 = .10$, found in our studies, must be considered in reference to .25, as a large effect size, and not .99 (Preacher & Kelley, 2011, p. 107).

Practical Implications

Our findings have important implications for advertisers. Advertisers often use amusing advertisements to persuade consumers to like and buy their products (Weinberger, Spotts, Campbell, & Parsons, 1995). The present findings reveal that the positive effects of these advertisements might diminish or even disappear when they are watched with someone who dislikes the ad, or at least demonstrates expressions that are incompatible with the intended emotions (i.e., smiling or
happiness). It would therefore be beneficial for advertisers to be aware of contexts in which consumers watch advertisements together, and with whom they watch them. The sync-watching that we defined in the introduction might be the next major consequence of an increasingly industrialized and interconnected world that advertisers should study.

Consumers may benefit from our findings because they imply that not smiling at an amusing commercial might help them resist (unwanted) persuasion by ads. When motivated to resist persuasion, a consumer may profit from the presence of another person who shows skepticism or disapproval through facial expression of disgust. We propose that, if consumers are motivated, they can effectively use their bodies to resist, particularly by exercising facial control. Such resistance seems to be effective as it exploits the intimate connection that exists between facial expressions and attitudes. This can be especially relevant when comprehension of the verbal message is difficult for vulnerable target groups. For example, parents may affect children’s responses to advertising by modulating their own facial expressions. Parents’ facial expressions may influence young children who cannot yet easily comprehend their parents’ verbal criticism of an advertisement, but who are presumably (automatically) mimicking their parents’ expressions. Likely, parents may thus change their child’s attitudes about particular advertisements by showing hindering expressions and hence preventing the formation of positive attitudes about a (undesirable) product or brand.
References


Jacob, R. J. K., & Karn, K. S. (2003). Eye tracking in Human-Computer Interaction and usability research: Ready to deliver the promises, In J. Hyönnä, R. Radach, & H. Deubel (Eds.), The mind's eye: Cognitive and applied aspects of eye movement research (pp. 573-605). Amsterdam: Elsevier.


Appendix A

Avatar development. Producing naturalistic facial expressions in computer graphics is a challenge, even for movie studios with large animation budgets. Frequently, expensive motion capture systems are required, and a sequence of scripted facial actions is recorded and retargeted onto a digital avatar. We chose to pursue a more flexible approach, developing a FACS-based avatar capable of creating a variety of on-demand facial expressions, through activation of weighted combinations of individual Action Units (AUs). The research work of Jack, Garrod, Yu, Caldeara, and Schyns (2012) and Lisetti, Yasavur, de Leaon, Amini, Rishe, and Visser (2012), among others, established this approach to avatar development. The three stages of the development of the virtual avatar were a) generation of a 3-dimensional digital representation of an actor capable of producing facial movements based on the Facial Action Coding System (FACS) (Ekman, Friesen, & Hager, 2002); b) determination of an optimal set of expressions temporally mapped to previously gathered facial reaction data for the stimuli advertisement; and c) animation of the avatar for addition to the video frame of the ad.

Deriving facial mimicry. We achieved the manipulation of facial mimicry by matching previously recorded and analyzed facial expression of happiness with corresponding hindering (disgust) or facilitating expressions (smiling) throughout the entire thirty seconds of the video stimuli. A basis for the facial mimicry – i.e., the temporal dynamics of avatar expression permutations - we derived from an existing data set gathered during a previous study. In that study, we instructed participants (n = 12, 50% women) to respond normally while viewing the same advertisement used in this set of experiments, for an example se W2 in Web Appendix. The Doritos ad had consistently good quality facial fitting results in FaceReader, so we chose it as the foundation for building the facial mimicking script for the avatar expressions. Two FACS certified coders (Ekman, Friesen, & Hager, 2002) - experts in objective facial coding – created the mimicry storyboard using prototypical facial expressions of disgust or happiness (see W3 and W4 in Web Appendix).

We captured the base polygonal mesh for the avatar using an Xbox 360 Kinect scanner, capable of computing depth maps of 3-dimensional objects through application of a structured light approach, using a system of projected infrared dots. Faceshift software drove the Kinect, generating a template mesh of a human FACS-certified actor, using a scanning and transformation process. By applying the geometry acquired during depth scanning of the actor, Faceshift warps a linear
Principal Components Analysis (PCA) base head model into an approximation of the subject’s face shape (Weise, Bouaziz, Li, & Pauly, 2011). In addition to supplying a template mesh of the human actor, Faceshift provides a high quality set of predefined facial expression blendshapes to accompany the 3-dimensional model. Blendshapes are linear transformations of an expression that range from 0 to 1, with 0 being a neutral expression and 1 being maximum facial activation for that expression. The creation of facial animations commonly requires blendshapes. While not labeled as such, the foundation for Faceshift’s blendshape library is the FACS system of craniofacial muscle movements. Autodesk Maya further refined the exported template mesh and accompanying blendshape library.

Changes made to the Faceshift model in Maya consisted largely of elimination of unnecessary blendshapes, adjustments to the morphologies and maximums of facial activations for particular movements, and addition of missing AUs. For example, the Faceshift sneer expression consisted of AUs 9 and 10 (responsible for disgust) so it was split into separate blendshape nodes. The resultant set of AUs, while not exhaustive of the motions codified in FACS, included a foundational set of 39 AUs and action descriptors (including unilateral activations where appropriate) adequate for representing a large subset of naturally occurring expressions. As will be specified in the next subsection, we used only AUs salient to the creation of prototypical expressions of disgust and happiness in our experiments.

To imbue the avatar with a more human appearance and increase user acceptance, the final development stage involved capturing and registering the actor’s unique facial structure for application to the digital model, in the form of a texture map. The texture generation was done with FaceReader, which records user images with a webcam and then applies an Active Appearance Model (Cootes & Taylor, 2004) to represent unique facial features. It does so by calculating the difference between the user’s appearance and a mean face prior. The resulting output is an averaged but highly representative shape and texture model of the actor. Maya also added a rudimentary hairstyle to the avatar.

**Facial expression scripting.** The goal of our experimental conditions was to either facilitate or inhibit facial expressions of happiness in response to an amusing advertisement. In the facilitation condition, avatars modeled varying degrees of smiling and laughter. For inhibition of expressed happiness, that is a contrary expression, we chose disgust as the emotion modeled by our embedded avatar. In both conditions, the modeled expressions ranged from 0 (neutral) to their maximum (rated as 1) throughout the course of the 30-second advertisement.
Deriving temporal expressions. We derived a basis for the temporal dynamics of avatar expression permutations from an existing data set gathered during a previous study. In that study, we instructed 25 participants in a control group to respond normally while viewing the same advertisement used in this set of experiments. We recorded all participants remotely, using their own webcams, and had their expressions analyzed offline by FaceReader. Of the 25 original participants, 12 (50% women) who had consistently good quality facial fitting results were chosen as the foundation for building an expression script. Poor quality expression fitting generally results from uneven lighting conditions, facial occlusions, and head movements on the part of the participants.

Normalization. Peak happiness intensity, as coded by FaceReader, averaged .2433 out of 1 across the 12 participants, with a minimum of 0. To maximize the potential for facilitation or inhibition of expressions of happiness in our experimental conditions, modeling the full emotional range of facial signaling was desirable. To achieve the most discriminable data set for our basis, we applied a min-max linear transformation to the original control data, rescaling it to the full possible range from 0 - 1. The transformation takes the general form of

\[ x' = \frac{x - \min(x)}{\max(x) - \min(x)} \]

where \( x' \) is the normalized transformation of an original data point \( x \). In this instance, we divided all values by the maximum of .2433 to obtain the desired scaling. Data points were video frames occurring at the rate of 25 frames per second for the duration of the advertisement. For each frame, we calculated measures of happiness, yielding a well-defined curve from which we derived the local minima, maxima, and inflection points. We used these as the foundation for establishing the timecodes where we placed animation keyframes. See Figure A.1 for a normalized graph.
We then visually formalized expression scripts through the creation of storyboards, indicating keyframes at transitional moments in the advertisement, concomitant example avatar expressions with their associated AUs and intensities, and notes indicating facial action dynamics between keyframes. We founded the intensity and combination of AUs displayed on prototypical configurations for happiness and disgust, as described in table 10-1 of the FACS Investigator’s Guide (Ekman, Friesen, & Hager, 2005). Tables A.1 and A.2 detail the breakdown of AUs and intensity displays associated with the normalized response curve values. For complete storyboards, see W3 and W4 in Web Appendix.

Table A.1

**Avatar's Facial Expressions Intensities in Facilitating Condition: Expressions of Happiness**

<table>
<thead>
<tr>
<th>Expression</th>
<th>Curve Range</th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-0.24</td>
<td>0.25-0.49</td>
<td>0.50-0.74</td>
<td>0.75-1.0</td>
</tr>
<tr>
<td>Slight</td>
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<td>AUs 6+12</td>
<td>AUs 6+12+25</td>
<td>AUs 6+12+25+26</td>
</tr>
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<td>0.3583</td>
<td>0.5333</td>
<td>0.708</td>
<td>0.8831</td>
</tr>
<tr>
<td>Moderate</td>
<td>0.4167</td>
<td>0.5917</td>
<td>0.7664</td>
<td>0.9414</td>
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<tr>
<td>Strong</td>
<td>0.475</td>
<td>0.6497</td>
<td>0.8247</td>
<td>0.9999</td>
</tr>
</tbody>
</table>

*Note. Curve range is a normalized 0 – 1 intensity scale of facial expressions of happiness displayed by a previously observed control group who responded to the unmodified ad; AUs = Action Units; Rows indicate the AUs and intensity floors displayed by the avatar for a given curve range.*
Table A.2

*Avatar's Facial Expressions Intensities in Hindering Condition: Expressions of Disgust*

<table>
<thead>
<tr>
<th>Expression</th>
<th>Curve Range</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>0-.33</td>
</tr>
<tr>
<td>Slight</td>
<td>AU 9/10</td>
</tr>
<tr>
<td>Moderate</td>
<td>0.377</td>
</tr>
<tr>
<td>Strong</td>
<td>0.454</td>
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<td></td>
<td>0.531</td>
</tr>
</tbody>
</table>

*Note.* Curve range is a normalized 0 – 1 intensity scale of facial expressions of happiness displayed by a previously observed control group who responded to the unmodified ad; AUs = Action Units; Rows indicate the AUs and intensity floors displayed by the avatar for a given curve range, with AU 9 combinations relating to scenes focused on Doritos, or the goat, and AU 10 combinations applied to scenes with the human actor as focal point.

Happiness. The FACS Investigator’s Guide lists only two AU combinations typical of happiness, both closed-mouth smiles. We created two more variations by adding AU 25 and AU 25+26 for open smiles with greater intensity. To create expressions strong enough to be recognizable, we applied an intensity floor of .3 to the happiness measurements and then normalized the AU intensities to range from 0-1. We considered combinations with a greater number of AUs more intense, and they were further broken down into slight, moderate, and strong expressions. We determined thresholds for AU intensities by dividing the four combinations into three subgroups, for a total of twelve intensity ranges, see Table A.1.

Disgust. For disgust, the FACS Investigator’s Guide lists six typical AUs combinations. Three involve AU 9, which wrinkles the nose, believed to be an innate physiological response to noxious odors. Action Unit 10 is indicated in the other three combinations; it is also found in expressions of anger. Because of these differences, we reserved combinations with AU 9 for video scenes focused on food (Doritos), or the goat. We applied action Unit 10 combinations to scenes in which the focus was on the human actor. To create expressions strong enough to be recognizable, we applied an intensity floor of .3 to the average happiness measurements, and then normalized the AU intensities to range from 0-1. We considered combinations with a greater number of AUs to be more intense, and they were further broken down into slight, moderate, and strong expressions. We determined thresholds for AU intensities by dividing each group by nine, as detailed in Table A.2.

Animation of the avatar and video editing. Based on keyframes specified in the storyboards (see W4 and W4 in Web Appendix), we animated the avatar by applying weighted AUs as described in the matrices in Tables A.1 and A.2. We added transition frames by interpolating between
keyframes, with morphing dynamics determined by the shape and slope of our reference control curve. We also added slight head and eye movements, as well as blinks, to create a more lifelike simulation. We made some ad-hoc expression adjustments during long stretches, where little variation would otherwise have occurred, but we maintained the integrity of the target expression.

To the lower right corner of the video-viewing frame, we added the embedded avatar, requiring that we scale down the advertisement. We cropped the avatar image to display only the head and neck, and sized it at a ratio of approximately .75:1 in height and .25:1 in width, relative to the screen coverage of the advertisement. With the exception of the neutral avatar control condition, we positioned the avatar’s eyes so that they appear to be observing the ad as it plays. Other than scaling, we made no changes to the ad itself.

A limitation of our studies is that we showed the avatars on only one side of the advertisement: the bottom right corner. It could be possible that consumers would have paid different amounts of attention to such an additional stimulus if we placed it, for example on the left side, which could subsequently have an effect on expression, attitudes, and attention. Future research could focus on the placing of the avatars. Do they have similar effects when they are placed on different locations?

**Manipulation Check**

In Study 2, in the three conditions (as in the control condition, there was no avatar), we asked people about their perceptions of avatar reactions and its presence. In facilitating, hindering, and no expression condition 98%, 100%, and 93% of people respectively “notice there was a video of a digital person (avatar) on the screen” and 97%, 97%, and 95% of people respectively indicated the part of the screen on which the avatar was placed (bottom-right corner). See Table A.3 for the nine questions and scale used, as well as the summary of results.

There were no differences between smiling, disgusted, or unexpressive avatar drawing participants’ self-reported attention, or influencing their liking for the advertisement (p > .40). The descriptive statistics show that people scored mostly around the scale middle point for the attention measure (i.e., 4 on the 1-7 scale, Question 1; see Table A.3). However, they report they were almost never (i.e., 2 on the 1-7 scale) influenced by the avatar’s presence (Question 2) nor its reactions, i.e., its facial expression (Questions 3). There were significant differences between the conditions in how participants perceived the avatar’s reactions as appropriate (Question 4); similar to participants’ own (Question 5); neutral (Question 6); happy (Question 7); disgusted (8); or positive/negative (Question 9), all p < .05. In general, participants in the disgusted avatar (i.e., hindering expression) condition
saw the avatar as reacting inappropriately (i.e., presumably incongruently) and less similarly to participants’ own expression than participants in other conditions. In addition, participants who saw the disgusted avatar reported that it was more disgusted and less happy than participants who saw either the smiling or the unexpressive avatar. See Table A.3 for the overview of descriptive for these questions.
Table A.3

Perception of Avatar across Experimental Conditions in Study 2

<table>
<thead>
<tr>
<th>Question</th>
<th>Content</th>
<th>Expression Condition</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>n</td>
<td>Facilitating</td>
<td>Hindering</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Draw attention¹</td>
<td>3.79</td>
<td>1.69</td>
<td>3.49</td>
<td>1.45</td>
<td>3.53</td>
<td>1.58</td>
<td>0.25</td>
</tr>
<tr>
<td>2</td>
<td>Presence’s influence²</td>
<td>2.18</td>
<td>1.84</td>
<td>1.86</td>
<td>1.27</td>
<td>1.90</td>
<td>1.37</td>
<td>0.49</td>
</tr>
<tr>
<td>3</td>
<td>Expressions’ influence³</td>
<td>2.20</td>
<td>1.96</td>
<td>1.78</td>
<td>1.21</td>
<td>1.80</td>
<td>1.44</td>
<td>0.88</td>
</tr>
<tr>
<td>4</td>
<td>Appropriate⁴</td>
<td>4.50</td>
<td>1.90</td>
<td>3.86</td>
<td>1.60</td>
<td>3.5</td>
<td>1.54</td>
<td>3.60ᵇ</td>
</tr>
<tr>
<td>5</td>
<td>Similar⁵</td>
<td>3.58</td>
<td>1.87</td>
<td>2.14</td>
<td>1.29</td>
<td>2.41</td>
<td>1.66</td>
<td>8.61ᵃᵇ</td>
</tr>
<tr>
<td>6</td>
<td>Neutral⁶</td>
<td>3.31</td>
<td>1.57</td>
<td>2.97</td>
<td>1.68</td>
<td>5.00</td>
<td>1.81</td>
<td>17.35ᵇᶜ</td>
</tr>
<tr>
<td>7</td>
<td>Happy⁷</td>
<td>5.35</td>
<td>1.61</td>
<td>3.68</td>
<td>1.53</td>
<td>2.82</td>
<td>1.62</td>
<td>25.96ᵃᵇᶜ</td>
</tr>
<tr>
<td>8</td>
<td>Disgusted⁸</td>
<td>1.36</td>
<td>0.87</td>
<td>2.59</td>
<td>1.61</td>
<td>2.62</td>
<td>1.66</td>
<td>9.87ᵃᵇ</td>
</tr>
<tr>
<td>9</td>
<td>Reactions⁹</td>
<td>5.48</td>
<td>1.55</td>
<td>3.62</td>
<td>1.50</td>
<td>3.93</td>
<td>0.94</td>
<td>21.08ᵃᵇ</td>
</tr>
</tbody>
</table>

¹- To what extent did the avatar draw your attention while you were watching the video? (Not at all (=1) - A lot (=7))
²- To what extent do you think the avatar’s presence influenced your liking for the advertisement? (Not at all (=1) - A lot (=7))
³- To what extent do you think the avatar’s reactions (facial expressions) influenced your liking for the advertisement (Not at all (=1) - A lot (=7))
⁴- Do you think that the avatar’s reactions to the video were appropriate? (Not at all (=1) - A lot (=7))
⁵- How similar to you was the avatar? (Not at all (=1) - A lot (=7))
⁶- To what extent do you think the avatar was Neutral (Not at all (=1) - A lot (=7))
⁷- To what extent do you think the avatar was Happy (Not at all (=1) - A lot (=7))
⁸- To what extent do you think the avatar was Disgusted (Not at all (=1) - A lot (=7))
⁹- Do you think that the avatar’s reactions to the video seemed: (negative (=1) - neutral (=3) - positive (=7))

ᵃ- difference (p < .05) between facilitating and hindering expression condition; ᵇ- difference (p < .05) between facilitating and no expression condition; ᶜ- difference (p < .05) between hindering and no expression condition
Appendix B

A sample of 194 participants successfully completed the study, which means that we recorded each of them once, after they filled in the questionnaire and watched the advertisement. We excluded the participants *a priori* to the analyses, following the FaceReader manual. We excluded 38 participants due to different reasons:

- Two participants did not have valid questionnaire results.
- The length of six participants’ facial recordings differed markedly from the others.
- Seven participants’ recordings had a different from accepted frame rate (different from 25 frames per second).
- The quality of 23 participants’ recordings was poor. We defined poor as less than 10% of the video frames analyzed by FaceReader.

In the end, the sample of participants consisted of 156 participants (Men = 76, Women = 80, average age = 31.54; $SD = 11.44$), as reported in the main body of text.
Appendix C

A sample of 135 participants successfully completed the study, which means that we recorded each of them once, after they filled in the questionnaire and watched the advertisement. We excluded the participants a priori to the analyses, following the FaceReader. We excluded 18 participants due to different reasons:
- Nine participants did not have valid questionnaire results or they saw the ad before.
- The quality of nine participants’ recordings was poor. We defined poor as less than 10% of the video frames analyzed by FaceReader.

In the end, the sample of participants consisted of 117 (Men = 27, Women = 90, average age = 22.31; SD = 4.73): as reported in the main body of text.
Appendix D

We excluded recordings from participants whose eye movements were missed for more than 50% of time of the recording. The missing data was assumed to be randomly distributed and it reflected problems in the recording of eye movement. Thus, if all data were included it would produce biased estimates of eye movement. According to good practices in eye tracking research we also looked into data quality and excluded outliers with extremely short and long fixations (−/+ 2SD), i.e., short fixations lasted less than the 50 milliseconds which is required to acquire information in complex visual scenes (van Diepen, de Graef, & d’Ydewalle, 1995) and long fixation which might indicate issues in data recording. After applying these criteria our sample of valid eyetracking data changed from 135 participants (see Appendix C) to 57 participants (see main body of the text).
Web Appendix

Visualization of Participant’s Eye Movements in Hindering Expression Condition

https://www.dropbox.com/s/69z9k7eyj6lx9eg/Disgusting%20avatar%20heat%20map%20radius%20209px%20all%20participants%20%28Converted%29.mov?dl=0;

Visualization of Participant’s Eye Movements Control Condition

https://www.dropbox.com/s/4uapz5guh6xsar3/No%20avatar%20heat%20map%20radius%2029px%20all%20participants%20%28Converted%29.mov?dl=0

W1. Commercial for Hindering Condition with a Disgusted Avatar
https://www.dropbox.com/s/lqofrfmy0hz7hix/W1.%20Doritos_hindering_disgusted_avatar.flv

W2. Visualization of a Participant’s Facial Reactions to the Advertisement
https://www.dropbox.com/s/uboglz0t44nrhwd/W2.%20FR_happy_avatar_happiness_full_screen.flv

W3. Storyboard for Hindering Condition (Disgusted Avatar)
https://www.dropbox.com/s/yod9mu6g4mqave5/W3.%20storyboard_disgust.pdf

W4. Storyboard for Facilitating Condition (Happy Avatar)