**In the eye of the beholder: A comprehensive analysis of stimulus type, perceiver, and target in physical attractiveness perceptions**

Molly A. Bowdring (Orcid ID: 0000-0001-5115-274X), Michael A. Sayette (Orcid ID: 0000-0001-7617-5198)

University of Pittsburgh

Jeffrey M. Girard (Orcid ID: 0000-0002-7359-3746)

Carnegie Mellon University

William C. Woods (Orcid ID: 0000-0002-8385-9106)

University of Pittsburgh

Word count: 7,060

**Abstract**

Physical attractiveness plays a central role in psychosocial experiences. One of the top research priorities has been to identify factors affecting perceptions of physical attractiveness (PPA). Recent work suggests PPA derives from different sources (e.g., target, perceiver, stimulus type). Although smiles in particular are believed to enhance PPA, support has been surprisingly limited. This study comprehensively examines the effect of smiles on PPA and, more broadly, evaluates the roles of target, perceiver, and stimulus type in PPA variation. Perceivers (*n* = 181) rated both static images and 5-sec videos of targets displaying smiling and neutral-expressions. Smiling images were rated as more attractive than neutral-expression images (regardless of stimulus motion format). Interestingly, perceptions of physical attractiveness were based *more* on the perceiver than on either the target or format in which the target was presented. Results clarify the effect of smiles, and highlight the significant role of the perceiver, in PPA.

**Keywords.** Attraction, person perception, smiling, facial expressions, G-theory.

Decades of research have established the importance of physical attractiveness in social functioning (Agocha & Cooper, 1999; Berscheid, 1980; Little et al., 2011; Thornton & Moore, 1993). It therefore is important to understand precisely which factors influence perceptions of physical attractiveness (PPA). While most attractiveness research has focused on stable characteristics of the target (the person being perceived), such as facial symmetry, there also may be temporary and contextual qualities that influence PPA (Zebrowitz & Montepare, 2008). One of the most intuitive potential moderators of PPA is smiling. Despite conventional wisdom highlighting the attractiveness of a smile, to date empirical scrutiny has been sparse. Studies that have been conducted often use suboptimal methodological approaches linked to stimuli selection and analytical strategy. The present study expands on prior work by using stimuli displaying naturally occurring smiles defined by a standardized coding system (Ekman & Friesen, 1978), presented in both static and dynamic formats. Using a fully crossed design (expression $× $motion), we assess the effect of smiling on PPA while accounting for motion of stimuli, participant sexual orientation, and target and perceiver gender. We also leverage generalizability theory (Brennan, 2001) to evaluate the relative contribution of stimulus type in PPA variance. Results of these analyses have the potential to inform methodological approaches and theoretical considerations in physical attractiveness research.

**Smiles and Perceptions of Physical Attractiveness**

Smiles are typically interpreted as conveying positive states and traits (e.g., sociability, generosity, positive mood) (Mehu et al., 2007; Miles & Johnston, 2007) that have been linked to enhanced PPA (Mathes & Kahn, 1975; Meier et al., 2010) – an observation not lost on advertising executives, orthodontists, and politicians, among others. Beyond conventional wisdom, multiple theoretical perspectives suggest the potential for smiling to enhance PPA.

From an evolutionary standpoint, qualities that indicate health and fitness are expected to contribute to increased PPA (Thornhill & Gangestad, 1999), and smiling faces are perceived to be healthier than neutral faces (Jones et al., 2018). Relatedly, the ecological approach to person perception claims that “perceiving is for doing,” emphasizing that social perception is a functional process that facilitates attainment of affordances (i.e., qualities or abilities of the target that will benefit the perceiver, such as good genes for mating) (Zebrowitz, 2011). Thus, the degree to which faces convey desirable affordances should influence PPA. Smiling faces convey not only affordances of good health, but also affiliation tendencies (Hess et al., 2000), which are desirable for most perceivers (Baumeister & Leary, 1995). Feelings-as-information theory posits that feelings are a source of information that contribute to various judgments (Schwarz, 2012) and research demonstrates the capacity for mood states to alter facial preferences (Pettijohn & Tesser, 2005). Importantly, targets’ facial expressions can influence perceivers’ moods, such that a smiling face may evoke feelings of happiness in the perceiver (Wild et al., 2001). This research reveals that facial expressions of targets can alter mood states in perceivers and thereby differentially influence PPA. Because positive mood states typically induce positive social judgments (Bower, 1991), a smiling target would likely be perceived as more attractive.

Unfortunately, in contrast to the dynamic, expressive nature of real-world PPA experiences (e.g., catching a smile from someone across the bar), the vast majority of PPA studies have relied on static images of targets with neutral facial expressions (Penton-Voak, 2011), which has limited examination of the smiling-PPA relationship. Surprisingly, results of the relatively few studies that have contrasted neutral and smiling images have been inconsistent.

Some studies have found a positive effect of smiling on PPA (Bohrn et al., 2010; Garrido et al., 2017; Garrido & Prada, 2017; Golle et al., 2014; Mehu et al., 2007; Otta et al., 1996; Reis et al., 1990). Yet other studies either have failed to detect a significant effect (Morrison et al., 2013; Mueser et al., 1984; Rhodes et al., 2011) or have only observed an effect under certain conditions. For instance, Penton-Voak & Chang (2008) detected a positive effect of smiling on PPA for ratings of female, but not male, targets. Okubo et al. (2015) observed a positive effect in women rating male targets in terms of long-term, but not short-term, relationships. Lee (2014) found the impact of smiling on PPA depended on the presence or absence of acne in the raters and targets. Indeed, the magnitude of the observed positive effect among extant studies has varied widely, with available effect sizes ranging from small (e.g., Morrison et al., 2013; Mueser et al., 1984; Okubo et al., 2015) to large (Garrido & Prada, 2017). Moreover, one study even reported a negative effect of smiling on PPA for male targets (no effect was found for female targets) (Rennels & Kayl, 2015). Given the assumption of both professionals and laypersons that smiling enhances PPA, these mixed findings have raised concern and led some investigators to question methods typically used to evaluate the effect of smiling on PPA (Penton-Voak, 2011).

**Methodological considerations.**  While a comprehensive discussion of factors that moderate prior effects of smiling on PPA is beyond the scope of this paper, the present focus is on key methodological considerations that have often been overlooked in the study of smiling and PPA. We believe integration of these considerations will advance this area of research, and may help to explain some of the inconsistencies in past work.

One key methodological aspect of past PPA studies concerns the nature of the target images. To our knowledge, all prior studies testing the smiling-PPA relation have presented targets displaying *posed* expressions. Because targets are perceived more positively when depicting spontaneous as opposed to posed smiles (Miles & Johnston, 2007) and perceivers can often differentiate posed from spontaneous smiles (Krumhuber & Manstead, 2009), prior research may have inadvertently compromised the effects of smiling on PPA. The present study sought to remedy this concern by assessing the smiling-PPA relation using images of targets evincing naturally occurring, unscripted, smiles (see Hughes & Aung, 2018). Moreover, in contrast to less objective approaches typically used in prior studies, the present study selected stimuli using the Facial Action Coding System (Ekman et al., 2002), which allowed the distinguishing facial expressions of our stimuli to be carefully controlled and standardized.

In addition to relying on posed smiles, researchers assessing smiling and PPA have not always distinguished whether the perceiver is sexually attracted to the gender of the target (e.g., Bohrn et al., 2010; Garrido et al., 2017; Morrison et al., 2013; Penton-Voak & Chang, 2008; Rennels & Kayl, 2015). This distinction is important, as there are non-overlapping behavioral affordances (i.e., benefits offered by the target, such as potential for romantic love) in these different perception processes that may alter PPA (Zebrowitz & Montepare, 2008). While some researchers have attempted to examine this distinction (e.g., Mueser et al., 1984; Okubo et al., 2015; Rhodes et al., 2011), they have done so merely by comparing “opposite-sex” (target and perceiver sex differ) and “same-sex” (target and perceiver sex match) ratings, as PPA studies to date have largely limited participant recruitment to heterosexual (or presumed heterosexual) individuals. Studies failing to assess sexual orientation undermine power by introducing within-condition variability, while those recruiting only heterosexual participants limit generalizability.

In an effort to promote more inclusive language (Sell, 2007), we use the term “orientation-matched” to refer to ratings that are of individuals of the gender to which the perceiver is sexually-oriented. As the field moves to incorporate greater diversity of participant sexual orientation, this language will ensure researchers have an accurate and concise way of labeling these seemingly distinct perception experiences (e.g., orientation-matched ratings are likely more relevant to risky sexual behavior than “orientation-mismatched” ratings – i.e., ratings of individuals who are not of the gender to which the perceiver is sexually oriented). Allowing for diversity of participant sexual orientation, the present study tested whether orientation-match moderated the effect of facial expression (smiling vs. neutral expression) on PPA.

Past research also has tended to rely on static images. Person perception researchers, however, have stressed that dynamic stimuli better convey target information than do static images, and have called for utilization of the former in order to examine richer perception experiences that more closely mirror those in naturalistic settings (Rubenstein, 2005; Zebrowitz & Montepare, 2008). Particularly relevant to assessing the effect of smiling on PPA is that static, compared to dynamic, stimuli reduce the perceived intensity of emotional expression (Biele & Grabowska, 2006)[[1]](#footnote-1), thereby decreasing the capacity for a smile to influence PPA. Moreover, dynamic, expressive images display more affordances and induce higher emotional arousal among perceivers than do static, expressive images (Wieser & Brosch, 2012; Zebrowitz, 2011). Thus, both the ecological perspective and feelings-as-information theory suggest an effect of smiling on PPA would be better evoked by dynamic stimuli.

While most studies testing the effect of smiling on PPA have been limited by their reliance on static images (see Penton-Voak & Chang, 2008), a few have incorporated motion into their stimuli. Rhodes and colleagues (2011) found no effect of motion or smiling on PPA. Garrido and colleagues (2017) did observe enhanced PPA among dynamic (as compared to static) images, though not when comparisons were restricted to neutral or smiling conditions, respectively. Researchers have noted a positive effect of motion on PPA for ratings of female, but not male, targets (Rennels & Kayl, 2015), while others detected a positive effect for male, but not female, targets (Penton-Voak & Chang, 2008). Taken together, results from these studies have been inconsistent with regard to the effect of both motion and, as noted above, smiling.

Among these studies, however, some utilized only closed-mouth smiles (Garrido et al., 2017; Golle et al., 2014; Rennels & Kayl, 2015), despite past research demonstrating that open-mouth smiles increase perceived smile authenticity (Korb et al., 2014; Krumhuber et al., 2009). Additionally, none had participants systematically rate each target in each stimulus condition (i.e., static-neutral, static-smiling, dynamic-neutral, dynamic-smiling), which limits the potential to detect a full range of PPA effects. Because the effect of target identity (i.e., the compilation of stable face traits) likely influences PPA much more than that of smiling or motion, these latter effects are likely to be lost when a participant lacks the opportunity to view each target in each expression condition (see Okubo et al., 2015). Moreover, permitting participants to view each target only once – as has been the practice of most smiling-PPA researchers to date (Mehu et al., 2007; Morrison et al., 2013; Mueser et al., 1984; Otta et al., 1996; Penton-Voak & Chang, 2008; Reis et al., 1990; Rennels & Kayl, 2015; Rhodes et al., 2011) – precludes evaluation of idiosyncratic attractiveness preferences (i.e., variance in PPA that derives from an interaction between target and perceiver effects). Utilizing open-mouth smiling images, participants in the present study rated all targets in all stimulus formats to test whether stimulus motion (static vs. dynamic) moderated the smiling-PPA relation.

**Assessing sources of variance in PPA.** Research that has contrasted smiling and neutral expressions has primarily relied on relatively simple statistical effects, such as Cronbach’s alpha, correlations, and mixed-effects ANOVAs (e.g., Garrido et al., 2017; Garrido & Prada, 2017; Mueser et al., 1984; Penton-Voak & Chang, 2008; Reis et al., 1990; Rhodes et al., 2011), which have limitations. For example, Cronbach’s alpha and correlations fail to account for the nested structure of data, confounding target main effects (the tendency of one target to consistently elicit higher ratings than another) and perceiver main effects (the trait-like tendency of one perceiver to give higher ratings on average than another). Such approaches have led researchers to largely neglect inter-individual differences in attractiveness preferences, which has restricted the scope of our understanding of sources of variance in PPA.

Importantly, there is emerging support for the role of the perceiver in PPA. In a series of three experiments on PPA with heterogeneous sets of targets and perceivers, Hönekopp (2006) revealed that “private taste” (the perceiver $× $target interaction effect, with or without the addition of the perceiver effect)[[2]](#footnote-2) consistently contributed to substantial variance in PPA. Though related research has been limited, studies that have parsed perceiver and target effects on PPA have similarly revealed substantial contributions of private taste compared to shared taste (the target main effect), with the ratio ranging from about 1:2 to 2:1 (Bronstad & Russell, 2007; Germine et al., 2015; Hehman et al., 2017; Kramer et al., 2018; Leder et al., 2016). These findings indicate that it is crucial to consider perceiver $×$ target effects when attempting to explain PPA variance.

Thus, while findings derived from traditional analytic approaches in smiling-PPA studies provide preliminary evidence for variability across expression type, alternative statistical techniques can more precisely quantify the contribution of target presentation format (i.e., stimulus type) relative to other factors (e.g., target and perceiver effects) in explaining PPA variability. Contemporary methods that can detect influences due to stimulus type (e.g., smiling vs. neutral expression), holding constant the effects of perceiver and target, come in a variety of forms, broadly termed multilevel models. These models disambiguate variance due to perceiver effects (how much variance in the outcome is due to differences in perceiver scores across all targets and stimulus types), target effects (how much variance in the outcome is due to differences in targets scores across all perceivers and stimulus types; interrater agreement), and the interaction of perceiver and target effects (idiosyncratic differences in the attractiveness preferences between perceivers across different stimulus types), and allow for detection of the unique effect of smiles. Although these models can detect such effects, they do not reveal the relative amount of variance in the outcome variable due to main effects and interactions in the model. That is, a multilevel model can detect a significant effect of smiles, given a large enough sample, even if the relative amount of variance explained is modest. By failing to describe effects in relative terms, the composition of variance in a construct can be easily misunderstood. One way of determining the relative importance of different effects on a variable is through a generalizability theory analysis (i.e., variance component partitioning) (Brennan, 2001; Vispoel et al., 2018).

Traditional models based on Classical Test Theory, from which Cronbach’s alpha and similar tests are derived, measure the extent to which a specific set of stimuli hang together and yield a single score reflecting how much overlap there is in the ratings across targets or perceivers.  Generalizability Theory (G-theory) itself is based upon the premise that, for the most part, researchers are not interested in any *specific*instantiation of a given construct (i.e., not the PPA based on any specific targets or the perceivers that rate them), but just happen to choose those targets and perceivers available to them out of an infinite set of possibilities.  Classical Test Theory detects statistical covariation in the items in a set, then provides an error term, such that person $×$ partner effects (or in the case of PPA, perceiver $×$ target effects) would be treated as error and not examined despite providing potentially interesting information. Generalizability Theory instead separates variance on the premise that each domain is using random rather than fixed stimuli.  As such, the assumptions made in the equations are different and the emphasis on breaking up the error term is paramount. Generalizability Theory takes what would be typically called the error term and partitions it into levels of variance to better explain the construct of interest.

Prior work using techniques derived from G-theory has demonstrated the importance of examining person $×$ partner effects in areas as diverse academic performance (Gross et al., 2015), athletic performance (Woods, Hayes, et al., 2016), and social support (Lakey & Orehek, 2011). For example, in the domain of academic performance, Gross and colleagues (2015) revealed idiosyncratic differences in teacher evaluations by students, meaning that variance in teacher evaluations was not solely explained by certain teachers always being rated higher than other teachers or certain students always providing higher ratings than other students. Instead, teacher effects, student effects, and student x teacher interaction effects each significantly contributed to the variance. Moreover, these idiosyncratic preferences predicted student memory for lectures, such that a student paired with a teacher they evaluated as highly effective remembered more of that teacher’s lecture than did other students. [For an excellent review of G-Theory and literatures that have made use of its antecedent analyses, see Lakey (2016).] In the present study, we include a G-theory approach to extend our analyses beyond the comparison of stimulus types. Specifically, we build on Hönekopp's (2006) study of perceiver and target effects by estimating the overall variance that stimulus types account for, relative to perceiver and target effects, when assessing PPA variation.  Variance partitioning of this kind is important because it provides clarity about the nature of the construct under scrutiny that can substantially increase precision in theories about the construct (Lakey, 2016).

**Present Study**

The present study sought to provide a comprehensive test of the impact of smiling – and, more broadly, stimulus type relative to target and perceiver – on PPA. It diverged from prior studies regarding how stimuli were developed, types of stimuli qualities assessed, and analytic approaches employed. We hypothesized that PPA ratings would be greater for smiling than neutral-expression stimuli (aim 1), the effect of facial expression on PPA would be greater for orientation-matched than orientation-mismatched ratings (aim 2), and the effect of facial expression on PPA would be greater for dynamic than static stimuli (aim 3). Per an anonymous reviewer, we tested the robustness of these findings by controlling for target and perceiver gender. We then assessed the contribution of stimulus type relative to target and perceiver effects in explaining PPA variation (aim 4).

**Method**

**Participants**

One-hundred-eighty-one participants were recruited through a psychology department subject pool. [Data from two of 183 original participants were excluded: one participant was outside the age range and one participant was a student of the first author, whose data we were concerned could have been influenced by experimental demand.] Participants were undergraduates enrolled in an introductory psychology course and completed the study for course credit. Participants were age 18-28 (to reduce likelihood of rater-target age discrepancy affecting attractiveness ratings, as targets were age 21-28) and have no uncorrected visual impairments. The majority of participants were white (74%), female (58.6%), heterosexual (89.5%), and not in romantic relationships (68.5%).

**Procedure**

The University’s Institutional Review Board approved the study. Participants signed up for an in-lab session through an online scheduling system. An individual session was scheduled for each participant. Upon arrival to the laboratory, participants were provided with informed consent forms, which a research staff member reviewed with them verbally. Those who agreed to participate were asked to silence their cell phones for the duration of their study participation. Participants were then instructed to begin the attractiveness rating task on a desktop computer in the lab room by themselves. The task lasted about 35 minutes, after which they completed a measure of demographic information. After task and measure completion, a research staff member returned to the lab room to debrief participants then permit them to leave.

**Materials**

**Attractiveness rating task.** Stimuli were derived from video footage of individuals who participated in a previous study conducted in the second author’s lab (see Citation Blinded). Videos were obtained from unstructured social interactions during a group-formation period, wherein 80 three-person groups of strangers (twenty groups of each gender composition: three males and zero females, two males and one female, one male and two females, zero males and three females) were brought into the lab and socialized while consuming a non-alcoholic beverage across 36 minutes. [The study from which the videos were derived had 240 3-person groups, split evenly among alcoholic, non-alcoholic, and placebo beverage conditions. The present study derived images exclusively from non-alcoholic beverage groups, to limit the potential for target drink condition to alter PPA (Van Den Abbeele et al., 2015).] Three cameras were positioned to capture each participant’s face. Participants were told the cameras were used to monitor drink consumption, though they were actually used to capture facial expressions during this unscripted social interaction. Images were only derived for participants who consented to having their videos used in future research.

Four types of stimuli were created: static smiling, static neutral, dynamic smiling, and dynamic neutral (see Figure 1).[[3]](#footnote-3) All stimuli were presented without audio. Consistent with recommendations from prior work, each target was presented in all four stimulus formats and viewed by every participant, to assess variability in PPA across stimulus types while controlling for baseline differences in PPA across targets (Okubo et al., 2015). The presentation duration of static and dynamic stimuli was held constant at five seconds and participants were given just one opportunity to view each stimulus. After each stimulus presentation, a screen prompting participants to rate the stimulus was presented until participants responded and clicked to progress to the next stimulus.

***Stimuli development.*** Videos were previously coded using the Facial Action Coding System (FACS) (Ekman et al., 2002), which is the gold standard for measuring visible facial movements (denoted by “action units” or “AUs”). This coding, as well as previously coded speech and beverage sipping behaviors, informed the frames of video extracted for stimuli creation. Frames from each stimulus type were non-overlapping with one another (Rennels & Kayl, 2015).  Sipping behavior and presence of the cup were absent from all images. Eye gaze in each frame of stimuli was directed away from the camera, as eye-gaze can alter PPA (Jones, DeBruine, Little, Conway, & Feinberg, 2006) and, due to the placement of the camera, our video dataset did not have sufficient images available to extract stimuli in which eye gaze was directed toward the camera. Each static stimulus was a single frame of video. Each dynamic stimulus was a five-second period of video in which the target was talking, as has been done in past research in order to capture facial dynamics that are typical of perception experiences in natural social interactions (e.g., Rennels & Kayl, 2015). FACS criteria for stimuli types are defined below (Ekman et al., 2002).

*Static smiling.*  Static smiling stimuli were single frames of video that encompassed open-mouth Duchenne smiles – AUs 6 (cheek raiser) + 12 (lip corner puller) + 25 (lips part). Duchenne smiles were selected because they have been found to be rated as appearing more genuine, positive, and attractive (Gunnery & Ruben, 2016). A certified FACS coder annotated the intensity of AU12 in each image using the official A (*trace*) through E (*maximum*) ordinal scale described in the Ekman et al. (2002) FACS manual (counts: A=0, B=1, C=13, D=17, E=5).

*Static neutral.*  Static neutral stimuli were single video frames that were absent of any emotion-relevant AUs (as confirmed by the first author, a certified FACS coder).

*Dynamic smiling.* Dynamic smiling stimuli were five-second clips of video that included AUs 6 + 12 + 25, wherein AU 6 was not present at the start of the clip but occurred at some point and remained present through the end of the clip (such that the image displayed the onset, but not offset, of the Duchenne smile, as the onset of a smile encompasses a key component of the social signal) (Cohn & Schmidt, 2004). A certified FACS coder annotated the maximum intensity of AU12 reached during each video (counts: A=0, B=0, C=13, D=19, E=4).

*Dynamic neutral.*  Dynamic neutral stimuli were five-second clips of video that included speech but were absent of any emotion-relevant AUs.

***Task set up.*** The stimuli used in the present study were derived from 36 targets (50% female). All participants viewed all 36 targets presented in all four stimulus formats. Stimuli were sorted into six blocks wherein each target was represented by only one stimulus in each block and stimulus formats were evenly distributed across blocks. Block order was randomized to create six versions of the task and participants were randomly assigned to receive one version of the task.

***Attractiveness ratings.*** Ratings were reported using a Likert scale of 1 (very unattractive) to 10 (very attractive).

**Demographics.** Participants reported their demographic information, including their gender and sexual orientation, after completing the attractiveness rating task.

***Orientation-match.*** Ratings were classified as orientation-matched according to the target’s gender (male or female), perceiver’s gender (male or female), and perceiver’s sexual-orientation (straight/heterosexual, gay/lesbian, or bisexual). For example, a rating of a male target would be orientation-matched for a heterosexual female or gay male, and orientation-mismatched for a heterosexual male or lesbian female. Target ratings of both genders were orientation-matched for the small portion (6.6%) of perceivers who identified as bisexual. [One participant responded, “Bi-curious”, using a *prefer to self-describe* short-response option. This participant was classified as bisexual due to their potential to be attracted to both genders represented in the stimuli set.]

**Analytic Plan**

To test the hypotheses associated with our first three aims, we estimated two multilevel regression models that accounted for the hierarchical structure of the data (i.e., ratings nested within targets and perceivers). In the first model, PPA ratings were regressed on the following predictors: a dummy code representing whether the stimulus was smiling (1) or neutral (0), a dummy code representing whether the stimulus was orientation-matched (1) or -mismatched (0), a dummy code representing whether the stimulus was dynamic (1) or static (0), and the interactions between the smiling and orientation dummy codes and the smiling and dynamic dummy codes. In the second model, we removed effects that were not significant and added in a dummy code representing whether the target was male (1) or female (0) and a dummy code representing whether the perceiver was male (1) or female (0). The maximal random effects structure was used in each model such that intercepts and all slopes were allowed to vary for each perceiver and each target (and random effects were correlated). The sample size provided 80% power to detect an effect as small as d=.08 (Westfall et al., 2014).

To test the hypotheses associated with our fourth aim, we conducted a G-theory analysis using another multilevel regression model (LoPilato et al., 2015). In this model, PPA ratings were regressed on random intercepts for each perceiver, target, and stimulus type. This model allowed us to decompose the variance in PPA ratings into seven different sources and compare their relative sizes: variance due to (1) targets, (2) perceivers, (3) stimulus types, (4) target-by-perceiver interactions, (5) target-by-stimulus-type interactions, (6) perceiver-by-stimulus-type interactions, and (7) residual variance including both measurement error and target-by-perceiver-by-stimulus-type interactions.

Both models were estimated within a Bayesian hierarchical modeling framework (Gelman et al., 2014) using the *brms* package (Bürkner, 2017) for the R statistical computing environment (R Core Team, 2019). Complete model details are provided in the supplemental materials including rating data, prior distributions, software versions, syntax, and output.

**Results**

The multilevel models we estimated to explore our first three aims converged successfully (i.e., all trace plots appeared random and all $\hat{R}$ values equaled 1.00). The results of the first model are summarized in Table 1. Neither of the interaction terms (smiling $×$ motion or smiling $×$ orientation-match) were significant, so they were dropped in the second model. Results of the second model, wherein target and perceiver gender terms were added, are summarized in Table 2 and depicted in Figure 2. Both models were comparable in terms of the total amount of the variance in PPA explained, and the magnitude of the expression and motion effects. Thus, we report in text only results of model 2, highlighting differences between the models as relevant. The total amount of variance explained by the second model was 65%, 95% HDI: [0.64, 0.65]. Our estimate of the intercept increased from 4.25 in the first model to 4.74, indicating that stimuli that were neutral, static, orientation-mismatched, female, and perceived by females tended to be rated around 4.74 on the 1 to 10 PPA scale. Smiling stimuli tended to be rated 0.22 units (or 0.12 SDs) higher and dynamic stimuli tended to be rated 0.18 units (or 0.10 SDs) higher. Male targets were rated .55 units (or .30 SDs) less attractive than female targets and male perceivers rated targets .41 units (or .22 SDs) less attractive than did female perceivers. All of these effects were statistically significant in that their posterior probability of being greater than zero (pd) was more than 95%; this is also shown in Figure2 where the majority of the probability density for each of these effects was above zero. While the effect of orientation-match was significant in the first model, it no longer remained significant after controlling for target and perceiver gender in the second model, in that the pd value for this effect was less than 95%.

The multilevel model we estimated to explore our fourth aim (the G-theory analysis) also converged successfully. The results of this model are summarized in Table 3 and depicted in Figure3. The largest variance components were due to differences between targets (21.8%), differences between perceivers (31.7%), and interactions between targets and perceivers (26.0%). Thus, some targets tended to be rated as more attractive than other targets (across perceivers and stimuli types), some perceivers tended to provide higher ratings than other perceivers (across targets and stimuli types), and some perceivers rated some targets as more attractive than did others (across stimuli types). The variance components were much smaller for differences between stimuli types (1.0%), interactions between targets and stimuli types (1.7%), and interactions between perceivers and stimuli types (1.1%). Finally, around 15.2% of the total variance in PPA ratings was residual (i.e., unmodeled). Because it is possible that perceivers did not agree in absolute terms but rather on relative terms (e.g., perceiver 1 rates target A as a 9 and target B as a 6, while perceiver 2 rates target A as a 7 and target B as a 4), we calculated ICCs representing absolute agreement (the perceiver component is included in the error estimate) and relative agreement (the perceiver component is not included in the error estimate) among perceivers. Both ICCs were low (ICCAbsolute = .22, ICCRelative = .32), indicating that there was poor agreement among perceivers in both relative and absolute terms (Koo & Li, 2016).

**Discussion**

Psychologists have long been interested in isolating physical features that influence perceptions of physical attractiveness. Despite “know it when you see it” notions of PPA that focus on target features (e.g., facial symmetry), studies of such constructs have yielded decidedly mixed results (c.f., Jones & Jaeger, 2019; Said & Todorov, 2011). Some investigators have suggested stimuli features, such as static vs. dynamic images, influence PPA (Hughes & Aung, 2018; Rubenstein, 2005). Less considered, but potentially critical to PPA, is the presence of smiles. Most instances wherein people evaluate one another’s physical attractiveness occur in social contexts, where smiling is common. Smiling is thought to enhance attractiveness and underpins sociobiological theories suggesting its adaptive function (Moore, 1985). Photographers long ago began eliciting smiles in their subjects. Thus, it is striking that extant research has offered only weak support for conventional wisdom that smiling enhances attractiveness. The present study incorporated advanced methods (e.g., spontaneous facial expressions drawn from unscripted social interactions; systematic facial coding of muscle movements to identify smiles; ratings of all targets by participants in a fully crossed design) and contrasted key study conditions (smiling vs. neutral, dynamic vs. static, orientation-matched vs. -mismatched) to examine the effect of smiling on PPA.

Data revealed smiles significantly enhance PPA, providing a critical test that may help clarify what has been a contradictory literature. That is, using advanced methods, our findings reinforce the credibility of results from prior work that has observed enhanced PPA among smiling targets. Motion of stimuli, target gender, and perceiver gender similarly had small, positive effects on PPA in the present study. Had we only conducted the initial multi-level modeling analyses, our discussion would stop here. Yet, by also conducting a G-theory analysis to compute the overall variance in PPA that stimulus type accounts for, we more precisely evaluated whether PPA derives primarily from the objective property of the target, how targets are presented, or the subjective preference of the perceiver. A key finding is that, while there were significant differences in PPA ratings due to stimulus type (e.g., smiling vs. neutral, static vs. dynamic), these differences were minor compared to perceiver effects, target effects, and the perceiver x target interaction effect. The significant effects of target and perceiver gender in the second model suggest that gender likely contributed to the perceiver and target effects in the G-theory analysis.

Importantly, we found perceivers to play a greater role than targets in PPA using the G-theory analysis. This was in spite of observing a larger effect of target gender than perceiver gender in the second model, suggesting that factors beyond gender also underlie the perceiver and target effects. While it is notable that the perceiver and perceiver $×$ target interaction effects were larger than the target effects given the general focus in past PPA studies on target features, perceiver characteristics also have proven dominant in other domains, such as ratings of personality (Fles & Lakey, 2017) and social interactions requiring cooperation (Woods, Lakey, et al., 2016). Though researchers have typically argued for the agreement in PPA across perceivers (e.g., Langlois et al., 2000), such claims have inadvertently been exaggerated, as perceiver effects and perceiver $×$ target effects have generally been subsumed by error terms in prior work. Using techniques that disambiguate these different components enables researchers to more precisely capture the variance and reveal that perceivers do indeed differ substantially in their attractiveness preferences. The relative importance of perceiver effects observed in the present study is consistent with the few PPA studies to date that have parsed perceiver and target effects (Bronstad & Russell, 2007; Germine et al., 2015; Hehman et al., 2017; Hönekopp, 2006; Kramer et al., 2018; Leder et al., 2016), and reinforces the value of including G-theory analyses alongside traditional multilevel models to assess these effects in future PPA research, and in person perception research more broadly.

**Limitations**

While the present study offers key methodological strengths,findings should be interpreted with respect to several limitations. Due to the unstructured nature of our video dataset, we were unable to extract stimuli for which target eye gaze and head orientation were directed toward the camera or for which other aspects of participants’ appearance (e.g., clothing, jewelry, hairstyle) were controlled. While perceivers may have given higher ratings if our stimuli displayed eye gaze and head orientation directed toward the camera (e.g., Ewing et al., 2010; Jones et al., 2006; Main et al., 2010), extant research does not seem to indicate that presenting stimuli with averted gazes and head orientations would have differentially influenced PPA of smiling vs. neutral targets. It is also unlikely that the other aspects of appearance (e.g., hairstyle) altered the observed effect of smiling, as these aspects of appearance were held constant across the expression conditions for each target. Nevertheless, if these other features did serve to distract perceivers, it might have slightly eroded the impact of smiles on PPA in the present study.

Another potential limitation concerns the emotional neutrality of the neutral expressions. Weighing against this concern, we selected stimuli using a standardized facial coding system (FACS) that facilitated identification of the presence vs. absence of smiles (if not the presence vs. total absence of resemblance to subtle emotionality). Subtle cues to emotion that persisted in our neutral stimuli are likely representative of those that present in naturalistic PPA experiences. Nevertheless, past work has shown that stable structural features of faces differentially resemble emotions (Said & Todorov, 2011; Zebrowitz et al., 2010), indicating perceivers may infer subtle emotional cues even among targets displaying neutral expressions. Among targets displaying smiling expressions, a limitation concerns the emotional intensity of the smiles. While we aimed to reduce variability in smiles across targets by restricting our selection of smiles to Duchenne (as opposed to non-Duchenne), there remained some variability in the intensity of smiles. It is possible that limiting smiles to maximal intensity could yield a larger effect of smiles on PPA or that a curvilinear relationship between smile intensity and PPA exists, such that at some point of increasing intensity smiles begins to have a negative effect on PPA. Future researchers could explore these possibilities by presenting smiles across the full range of intensities. More broadly, additional action units could be coded to tease apart different types of smiles (see Ekman, 2009). Finally, though G-theory aims to facilitate generalization of results to a broader universe of findings, it is limited by the set of observations on the which analyses are based. Future work is needed to assess the extent to which these findings hold with a more diverse set of targets and perceivers, such as in terms of age, ethnicity, and other factors that may alter PPA.

**Future Directions**

 While the effect of smiling was overshadowed by perceiver and target effects in the present study, the magnitude of the effect of smiles on PPA may be greater under conditions in which smiles convey immediate potential for attainment of behavioral affordances (e.g., pleasant social interaction). That is, smiling is a social signal that conveys warmth and sociability (Bayes, 1972; Kraut & Johnston, 1979; Reis et al., 1990) and may facilitate initiation and maintenance of social bonds (e.g., Martin et al., 2017; Moore, 2010). If behavioral affordances such as these contribute to PPA and are more salient when perceivers have real opportunity to obtain those affordances (Zebrowitz & Montepare, 2006), then smiling – and other nonverbal behaviors – may indeed have a greater influence on PPA in naturalistic settings. Relatedly, the social context in which the target is viewed should be considered. Past work has demonstrated that the attractiveness of targets is perceived differently according to their affiliation with others in the visual field and the attractiveness of those others (i.e., cues to friendship with attractive others enhances PPA of the target) (Geiselman et al., 1984; Walther et al., 2008). Future research will be needed to test smiling and PPA in contexts where the perceiver has potential to interact with the target, and wherein additional social cues (e.g., target affiliation with attractive others, other perceivers competing for target attention, availability of alternative targets) are assessed.

Results from our G-theory analysis indicate future research will benefit from exploring the specific characteristics that underlie unique attractiveness preferences of perceivers. Little and colleagues (2011) suggested internal characteristics of the perceiver, the context of perception, and visual experience with the target may yield both between and within perceiver variation in attractiveness preferences. Indeed, diverse factors including, but not limited to, personality preference, acute alcohol intoxication, political preference, and relationship status of the perceiver, have been shown to alter PPA (e.g., Bowdring & Sayette, 2018; Cole et al., 2016; Little et al., 2006; Nicholson et al., 2016). Comprehensive assessment of stable and temporary features of both the target and perceiver – as well as the context in which the perception occurs – within the same study will help to more fully elucidate the composition of PPA variance. It is important to recognize that the variance explained by different factors will likely vary based on the particulars of the study in which PPA is being assessed. For example, greater attractiveness-heterogeneity among targets should yield greater variance explained by target effects (Hönekopp, 2006). In many contexts, sexual orientation of the perceiver may play a key role in PPA. The role of sexual orientation in future PPA studies may be more accurately assessed by accounting for the non-discrete nature of sexual orientation through the use of assessments based on a continuum (Epstein et al., 2012; Kinsey et al., 1949). More broadly, PPA research is indicated that integrates naturalistic approaches and considers the dynamic processes linking perceivers and targets across multiple contexts.

**References**

Agocha, V. B., & Cooper, M. L. (1999). Risk perceptions and safer-sex intentions: Does a partner’s physical attractiveness undermine the use of risk-relevant information? *Personality and Social Psychology Bulletin*, *25*(6), 751–765.

Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin*, *117*(3), 497.

Bayes, M. A. (1972). Behavioral cues of interpersonal warmth. *Journal of Consulting and Clinical Psychology*, *39*(2), 333.

Berscheid, E. (1980). An overview of the psychological effects of physical attractiveness. *Psychological Aspects of Facial Form. Monograph*, *11*.

Biele, C., & Grabowska, A. (2006). *Sex differences in perception of emotion intensity in dynamic and static facial expressions*. *171*(1), 1–6.

Bohrn, I., Carbon, C.-C., & Hutzler, F. (2010). Mona Lisa’s smile—Perception or deception? *Psychological Science*, *21*(3), 378–380. http://dx.doi.org/10.1177/0956797610362192

Bowdring, M. A., & Sayette, M. A. (2018). Perception of physical attractiveness when consuming and not consuming alcohol: A meta-analysis. *Addiction (Abingdon, England)*, *113*, 1585–1597. https://doi.org/10.1111/add.14227

Bower, G. H. (1991). Mood congruity of social judgments. *Emotion and Social Judgments*, *31655*.

Brennan, R. L. (2001). *Generalizability theory. 2001*. New York: Springer-Verlag.

Bronstad, P. M., & Russell, R. (2007). Beauty is in the ‘We’ of the Beholder: Greater Agreement on Facial Attractiveness among Close Relations. *Perception*, *36*(11), 1674–1681. https://doi.org/10.1068/p5793

Bürkner, P.-C. (2017). brms: An R Package for Bayesian Multilevel Models Using Stan. *Journal of Statistical Software*, *80*(1), 1–28. https://doi.org/10.18637/jss.v080.i01

Cohn, J. F., & Schmidt, K. L. (2004). The timing of facial motion in posed and spontaneous smiles. *J. Wavelets, Multi-Resolution & Information Processing*, *2*, 1–12.

Cole, S., Trope, Y., & Balcetis, E. (2016). In the eye of the betrothed: Perceptual downgrading of attractive alternative romantic partners. *Personality and Social Psychology Bulletin*, *42*(7), 879–892.

Ekman, P., & Friesen, W. V. (1978). *The Facial Action Coding System*. Consulting Psychologists Press.

Ekman, P., Friesen, W. V., & Hager, J. C. (2002). *Facial Action Coding System on CD-Rom*. Network Information Research.

Ekman, Paul. (2009). *Telling lies: Clues to deceit in the marketplace, politics, and marriage (revised edition)*. WW Norton & Company.

Epstein, R., McKinney, P., Fox, S., & Garcia, C. (2012). Support for a fluid-continuum model of sexual orientation: A large-scale internet study. *Journal of Homosexuality*, *59*(10), 1356–1381.

Ewing, L., Rhodes, G., & Pellicano, E. (2010). Have you got the look? Gaze direction affects judgements of facial attractiveness. *Visual Cognition*, *18*(3), 321–330.

Fles, E., & Lakey, B. (2017). The personality traits of consensually supportive people. *Personality and Individual Differences*, *104*, 87–91. https://doi.org/10.1016/j.paid.2016.07.032

Garrido, M. V., Lopes, D., Prada, M., Rodrigues, D., Jerónimo, R., & Mourão, R. P. (2017). The many faces of a face: Comparing stills and videos of facial expressions in eight dimensions (SAVE database). *Behavior Research Methods*, *49*(4), 1343–1360. http://dx.doi.org/10.3758/s13428-016-0790-5

Garrido, M. V., & Prada, M. (2017). KDEF-PT: Valence, emotional intensity, familiarity and attractiveness ratings of angry, neutral, and happy faces. *Frontiers in Psychology*, *8*. http://dx.doi.org/10.3389/fpsyg.2017.02181

Geiselman, R. E., Haight, N. A., & Kimata, L. G. (1984). Context effects on the perceived physical attractiveness of faces. *Journal of Experimental Social Psychology*, *20*(5), 409–424.

Gelman, A., Carlin, J. B., Stern, H. S., Dunson, D. B., Vehtari, A., & Rubin, D. B. (2014). Bayesian Data Analysis, vol. 2 CRC Press. *Boca Raton, FL*.

Germine, L., Russell, R., Bronstad, P. M., Blokland, G. A. M., Smoller, J. W., Kwok, H., Anthony, S. E., Nakayama, K., Rhodes, G., & Wilmer, J. B. (2015). Individual Aesthetic Preferences for Faces Are Shaped Mostly by Environments, Not Genes. *Current Biology*, *25*(20), 2684–2689. https://doi.org/10.1016/j.cub.2015.08.048

Golle, J., Mast, F. W., & Lobmaier, J. S. (2014). Something to smile about: The interrelationship between attractiveness and emotional expression. *Cognition and Emotion*, *28*(2), 298–310. https://doi.org/10.1080/02699931.2013.817383

Gross, J., Lakey, B., Lucas, J. L., LaCross, R., R. Plotkowski, A., & Winegard, B. (2015). Forecasting the student–professor matches that result in unusually effective teaching. *British Journal of Educational Psychology*, *85*(1), 19–32.

Gunnery, S. D., & Ruben, M. A. (2016). Perceptions of Duchenne and non-Duchenne smiles: A meta-analysis. *Cognition and Emotion*, *30*(3), 501–515.

Hehman, E., Sutherland, C. A. M., Flake, J. K., & Slepian, M. L. (2017). The unique contributions of perceiver and target characteristics in person perception. *Journal of Personality and Social Psychology*, *113*(4), 513–529. https://doi.org/10.1037/pspa0000090

Hess, U., Blairy, S., & Kleck, R. E. (2000). The influence of facial emotion displays, gender, and ethnicity on judgments of dominance and affiliation. *Journal of Nonverbal Behavior*, *24*(4), 265–283.

Hönekopp, J. (2006). Once more: Is beauty in the eye of the beholder? Relative contributions of private and shared taste to judgments of facial attractiveness. *Journal of Experimental Psychology: Human Perception and Performance*, *32*(2), 199–209. https://doi.org/10.1037/0096-1523.32.2.199

Hughes, S. M., & Aung, T. (267 C.E.). Symmetry in motion: Perception of attractiveness changes with facial movement. *Journal of Nonverbal Behavior*, *42*(3), No Pagination Specified.

Jones, A. L., Batres, C., Porcheron, A., Sweda, J. R., Morizot, F., & Russell, R. (2018). Positive facial affect looks healthy. *Visual Cognition*, *26*(1), 1–12. https://doi.org/10.1080/13506285.2017.1369202

Jones, A. L., & Jaeger, B. (2019). Biological bases of beauty revisited: The effect of symmetry, averageness, and sexual dimorphism on female facial attractiveness. *Symmetry*, *11*(2), 279.

Jones, B. C., DeBruine, L. M., Little, A. C., Conway, C. A., & Feinberg, D. R. (2006). Integrating Gaze Direction and Expression in Preferences for Attractive Faces. *Psychological Science*, *17*(7), 588–591. http://dx.doi.org/10.1111/j.1467-9280.2006.01749.x

Kinsey, A. C., Pomeroy, W. B., & Martin, C. E. (1949). Sexual behavior in the human male. *The Journal of Nervous and Mental Disease*, *109*(3), 283.

Koo, T. K., & Li, M. Y. (2016). A Guideline of Selecting and Reporting Intraclass Correlation Coefficients for Reliability Research. *Journal of Chiropractic Medicine*, *15*(2), 155–163. https://doi.org/10.1016/j.jcm.2016.02.012

Korb, S., With, S., Niedenthal, P., Kaiser, S., & Grandjean, D. (2014). The Perception and Mimicry of Facial Movements Predict Judgments of Smile Authenticity. *PLOS ONE*, *9*(6), e99194. https://doi.org/10.1371/journal.pone.0099194

Kramer, R. S. S., Mileva, M., & Ritchie, K. L. (2018). Inter-rater agreement in trait judgements from faces. *PLoS ONE*, *13*(8). https://doi.org/10.1371/journal.pone.0202655

Kraut, R. E., & Johnston, R. E. (1979). Social and emotional messages of smiling: An ethological approach. *Journal of Personality and Social Psychology*, *37*(9), 1539.

Krumhuber, E. G., & Manstead, A. S. (2009). Can Duchenne smiles be feigned? New evidence on felt and false smiles. *Emotion*, *9*(6), 807.

Krumhuber, E., Manstead, A. S. R., Cosker, D., Marshall, D., & Rosin, P. L. (2009). Effects of Dynamic Attributes of Smiles in Human and Synthetic Faces: A Simulated Job Interview Setting. *Journal of Nonverbal Behavior*, *33*(1), 1–15. https://doi.org/10.1007/s10919-008-0056-8

Lakey, B. (2016). Understanding the P x S aspect of within-person variation: A variance partitioning approach. *Frontiers in Psychology*, *6*, 2004.

Lakey, B., & Orehek, E. (2011). Relational regulation theory: A new approach to explain the link between perceived social support and mental health. *Psychological Review*, *118*(3), 482.

Langlois, J. H., Kalakanis, L., Rubenstein, A. J., Larson, A., Hallam, M., & Smoot, M. (2000). Maxims or myths of beauty? A meta-analytic and theoretical review. *Psychological Bulletin*, *126*(3), 390.

Leder, H., Goller, J., Rigotti, T., & Forster, M. (2016). Private and Shared Taste in Art and Face Appreciation. *Frontiers in Human Neuroscience*, *10*. https://doi.org/10.3389/fnhum.2016.00155

Lee, I.-S., Lee, A.-R., Lee, H., Park, H.-J., Chung, S.-Y., Wallraven, C., Bülthoff, I., & Chae, Y. (2014). Psychological distress and attentional bias toward acne lesions in patients with acne. *Psychology, Health & Medicine*, *19*(6), 680–686. http://dx.doi.org/10.1080/13548506.2014.880493

Little, A. C., Burt, D. M., & Perrett, D. I. (2006). What is good is beautiful: Face preference reflects desired personality. *Personality and Individual Differences*, *41*(6), 1107–1118. https://doi.org/10.1016/j.paid.2006.04.015

Little, A. C., Jones, B. C., & DeBruine, L. M. (2011). Facial attractiveness: Evolutionary based research. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *366*(1571), 1638–1659.

LoPilato, A. C., Carter, N. T., & Wang, M. (2015). Updating generalizability theory in management research: Bayesian estimation of variance components. *Journal of Management*, *41*(2), 692–717.

Main, J. C., DeBruine, L. M., Little, A. C., & Jones, B. C. (2010). Interactions among the effects of head orientation, emotional expression, and physical attractiveness on face preferences. *Perception*, *39*(1), 62–71.

Martin, J., Rychlowska, M., Wood, A., & Niedenthal, P. (2017). Smiles as Multipurpose Social Signals. *Trends in Cognitive Sciences*, *21*(11), 864–877. https://doi.org/10.1016/j.tics.2017.08.007

Mathes, E. W., & Kahn, A. (1975). Physical attractiveness, happiness, neuroticism, and self-esteem. *The Journal of Psychology*, *90*(1), 27–30.

Mehu, M., Little, A. C., & Dunbar, R. I. M. (2007). Duchenne smiles and the perception of generosity and sociability in faces. *Journal of Evolutionary Psychology*, *5*(1–4), 183–196. http://dx.doi.org/10.1556/JEP.2007.1011

Meier, B. P., Robinson, M. D., Carter, M. S., & Hinsz, V. B. (2010). Are sociable people more beautiful? A zero-acquaintance analysis of agreeableness, extraversion, and attractiveness. *Journal of Research in Personality*, *44*(2), 293–296. https://doi.org/10.1016/j.jrp.2010.02.002

Miles, L., & Johnston, L. (2007). Detecting happiness: Perceiver sensitivity to enjoyment and non-enjoyment smiles. *Journal of Nonverbal Behavior*, *31*(4), 259–275.

Moore, M. M. (1985). Nonverbal courtship patterns in women: Context and consequences. *Ethology and Sociobiology*, *6*(4), 237–247.

Moore, M. M. (2010). Human nonverbal courtship behavior—A brief historical review. *Journal of Sex Research*, *47*(2–3), 171–180.

Morrison, E. R., Morris, P. H., & Bard, K. A. (2013). The stability of facial attractiveness: Is it what you’ve got or what you do with it? *Journal of Nonverbal Behavior*, *37*(2), 59–67. http://dx.doi.org/10.1007/s10919-013-0145-1

Mueser, K. T., Grau, B. W., Sussman, S., & Rosen, A. J. (1984). You’re only as pretty as you feel: Facial expression as a determinant of physical attractiveness. *Journal of Personality and Social Psychology*, *46*(2), 469–478. http://dx.doi.org/10.1037/0022-3514.46.2.469

Nicholson, S. P., Coe, C. M., Emory, J., & Song, A. V. (2016). The Politics of Beauty: The Effects of Partisan Bias on Physical Attractiveness. *Political Behavior*, *38*(4), 883–898. https://doi.org/10.1007/s11109-016-9339-7

Okubo, M., Ishikawa, K., Kobayashi, A., Laeng, B., & Tommasi, L. (2015). Cool guys and warm husbands: The effect of smiling on male facial attractiveness for short- and long-term relationships. *Evolutionary Psychology*, *13*(3), 1–8. http://dx.doi.org/10.1177/1474704915600567

Otta, E., Abrosio, F. F. E., & Hoshino, R. L. (1996). Reading a smiling face: Messages conveyed by various forms of smiling. *Perceptual and Motor Skills*, *82*(3, Pt 2), 1111–1121. http://dx.doi.org/10.2466/pms.1996.82.3c.1111

Penton-Voak, I. (2011). In retreat from nature? Successes and concerns in Darwinian approaches to facial attractiveness. *Journal of Evolutionary Psychology*, *9*(2), 173–193.

Penton-Voak, I. S., & Chang, H. Y. (2008). Attractiveness judgements of individuals vary across emotional expression and movement conditions. *Journal of Evolutionary Psychology*, *6*(2), 89–100. http://dx.doi.org.pitt.idm.oclc.org/10.1556/JEP.2008.1011

Pettijohn, T. F., & Tesser, A. (2005). Threat and social choice: When eye size matters. *The Journal of Social Psychology*, *145*(5), 547–570.

R Core Team. (2019). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing.

Reis, H. T., Wilson, I. M., Monestere, C., Bernstein, S., & al, et. (1990). What is smiling is beautiful and good. *European Journal of Social Psychology*, *20*(3), 259–267. http://dx.doi.org/10.1002/ejsp.2420200307

Rennels, J. L., & Kayl, A. J. (2015). Differences in expressivity based on attractiveness: Target or perceiver effects? *Journal of Experimental Social Psychology*, *60*, 163–172.

Rhodes, G., Lie, H. C., Thevaraja, N., Taylor, L., Iredell, N., Curran, C., Tan, S. Q. C., Carnemolla, P., & Simmons, L. W. (2011). Facial attractiveness ratings from video-clips and static images tell the same story. *PloS One*, *6*(11), e26653.

Rubenstein, A. J. (2005). Variation in Perceived Attractiveness: Differences Between Dynamic and Static Faces. *Psychological Science*, *16*(10), 759–762. http://dx.doi.org.pitt.idm.oclc.org/10.1111/j.1467-9280.2005.01610.x

Said, C. P., & Todorov, A. (2011). A statistical model of facial attractiveness. *Psychological Science*, *22*(9), 1183–1190.

Sayette, M. A., Creswell, K. G., Dimoff, J. D., Fairbairn, C. E., Cohn, J. F., Heckman, B. W., Kirchner, T. R., Levine, J. M., & Moreland, R. L. (2012). Alcohol and group formation: A multimodal investigation of the effects of alcohol on emotion and social bonding. *Psychological Science*, *23*(8), 869–878.

Schwarz, N. (2012). *Feelings-as-Information Theory* (Vol. 1). Sage. https://doi.org/10.4135/9781446249215.n15

Sell, R. L. (2007). Defining and Measuring Sexual Orientation for Research. In I. H. Meyer & M. E. Northridge (Eds.), *The Health of Sexual Minorities: Public Health Perspectives on Lesbian, Gay, Bisexual and Transgender Populations* (pp. 355–374). Springer US. https://doi.org/10.1007/978-0-387-31334-4\_14

Thornhill, R., & Gangestad, S. W. (1999). Facial attractiveness. *Trends in Cognitive Sciences*, *3*(12), 452–460.

Thornton, B., & Moore, S. (1993). Physical attractiveness contrast effect: Implications for self-esteem and evaluations of the social self. *Personality and Social Psychology Bulletin*, *19*(4), 474–480.

Van Den Abbeele, J., Penton-Voak, I. S., Attwood, A. S., Stephen, I. D., & Munafò, M. R. (2015). Increased Facial Attractiveness Following Moderate, but not High, Alcohol Consumption. *Alcohol and Alcoholism*, *50*(3), 296–301. https://doi.org/10.1093/alcalc/agv010

Vispoel, W. P., Morris, C. A., & Kilinc, M. (2018). Applications of generalizability theory and their relations to classical test theory and structural equation modeling. *Psychological Methods*, *23*(1), 1–26. http://dx.doi.org/10.1037/met0000107

Walther, J. B., Van Der Heide, B., Kim, S.-Y., Westerman, D., & Tong, S. T. (2008). The role of friends’ appearance and behavior on evaluations of individuals on Facebook: Are we known by the company we keep? *Human Communication Research*, *34*(1), 28–49.

Westfall, J., Kenny, D. A., & Judd, C. M. (2014). Statistical power and optimal design in experiments in which samples of participants respond to samples of stimuli. *Journal of Experimental Psychology: General*, *143*(5), 2020.

Wieser, M. J., & Brosch, T. (2012). Faces in Context: A Review and Systematization of Contextual Influences on Affective Face Processing. *Frontiers in Psychology*, *3*. https://doi.org/10.3389/fpsyg.2012.00471

Wild, B., Erb, M., & Bartels, M. (2001). Are emotions contagious? Evoked emotions while viewing emotionally expressive faces: Quality, quantity, time course and gender differences. *Psychiatry Research*, *102*(2), 109–124.

Woods, W. C., Hayes, D. J., Meyer, F., Kardan, O., & Berman, M. G. (2016). Dynamic effects on elite and amateur performance. *Sport, Exercise, and Performance Psychology*, *5*(4), 308.

Woods, W. C., Lakey, B., & Sain, T. (2016). The role of ordinary conversation and shared activity in the main effect between perceived support and affect. *European Journal of Social Psychology*, *46*(3), 356–368.

Zebrowitz, L.A. (2011). Ecological and social approaches to face perception. In *The Oxford handbook of face perception* (pp. 31–50). Oxford University Press.

Zebrowitz, Leslie A., Kikuchi, M., & Fellous, J.-M. (2010). Facial resemblance to emotions: Group differences, impression effects, and race stereotypes. *Journal of Personality and Social Psychology*, *98*(2), 175.

Zebrowitz, Leslie A., & Montepare, J. M. (2006). The ecological approach to person perception: Evolutionary roots and contemporary offshoots. *Evolution and Social Psychology*, 81–113.

Zebrowitz, Leslie A., & Montepare, J. M. (2008). Social psychological face perception: Why appearance matters. *Social and Personality Psychology Compass*, *2*(3), 1497–1517.

Table 1

*Regression Coefficients from the Bayesian Multilevel Regression Model*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | B | $$β$$ | 95% HDI | pd |
| Intercept | 4.25 |  | [+3.92, +4.60] | 100.0% |
| Smiling (vs. Neutral) | 0.19 | 0.10 | [+0.02, +0.35] | 98.7% |
| Matched (vs. Mismatched) | 0.22 | 0.12 | [+0.00, +0.45] | 97.5% |
| Dynamic (vs. Static) | 0.16 | 0.09 | [+0.07, +0.26] | 99.9% |
| Smiling × Dynamic | 0.04 | 0.02 | [−0.09, +0.16] | 71.1% |
| Smiling × Matched | 0.02 | 0.01 | [−0.07, +0.12] | 66.8% |

*Note.* B = unstandardized coefficient (posterior median). $β$ = standardized coefficient (posterior median).
HDI = interval estimate (posterior highest density interval). pd = probability of direction (i.e., that estimate > 0).

Table 2

*Regression Coefficients from the Bayesian Multilevel Regression Model Controlling for Target and Perceiver Gender*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | B | $$β$$ | 95% HDI | pd |
| Intercept | 4.74 |  | [+4.23, +5.28] | 100.0% |
| Smiling (vs. Neutral) | 0.22 | 0.12 | [+0.10, +0.35] | 99.96% |
| Matched (vs. Mismatched) | 0.19 | 0.10 | [−0.16, +0.55] | 85.13% |
| Dynamic (vs. Static) | 0.18 | 0.10 | [+0.11, +0.26] | 100% |
| Target Gender | −0.55 | 0.30 | [−1.13, +0.02] | 97.02% |
| Perceiver Gender | −0.41 | 0.22 | [−0.76, −0.06] | 98.83% |

*Note.* B = unstandardized coefficient (posterior median). $β$ = standardized coefficient (posterior median).
HDI = interval estimate (posterior highest density interval). pd = probability of direction (i.e., that estimate > 0).

Table 3

*Results of the Bayesian G-Theory Analysis*

|  |  |  |  |
| --- | --- | --- | --- |
|  | Amount of Variance |  | Percent of Total Variance |
| Component | Estimate | 95% HDI |  | Estimate | 95% HDI |
| Target | 0.77 | [0.45, 1.22] |  | 21.8 % | [14.4, 31.2] |
| Perceiver | 1.12 | [0.90, 1.38] |  | 31.7 % | [25.7, 37.7] |
| Stimulus Type | 0.04 | [0.00, 0.20] |  | 1.0 % | [0.1, 5.4] |
| Target × Perceiver | 0.92 | [0.88, 0.96] |  | 26.0 % | [22.3, 29.5] |
| Target × Stimulus Type | 0.06 | [0.04, 0.08] |  | 1.7 % | [1.2, 2.2] |
| Perceiver × Stimulus Type | 0.04 | [0.03, 0.05] |  | 1.1 % | [0.9, 1.4] |
| Residual | 0.55 | [0.54, 0.56] |  | 15.2 % | [12.4, 17.6] |

*Note.* Estimate = point estimate (posterior median). HDI = interval estimate (posterior highest density interval).

1. We refer here to subjective perceived intensity, not intensity based on a standardized coding scheme (e.g., FACS). [↑](#footnote-ref-1)
2. See Hönekopp (2006) for discussion of different approaches to conceptualizing the perceiver main effect with respect to private taste. [↑](#footnote-ref-2)
3. Two additional stimuli types, in which dynamic smiling and neutral images including audio (i.e., vocalizations), were presented. We exclude these ratings as the audio was highly variable regarding content, volume, and clarity, complicating interpretation. Results do not meaningfully differ when the audio conditions are included. [↑](#footnote-ref-3)