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Temporal Aspects of Facial Displays in Person and Expression Perception: The Effects of Smile Dynamics, Head-tilt, and Gender

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Abstract Recent work suggests that temporal aspects of facial displays influence the perception of the perceived authenticity of a smile. In the present research, the impact of temporal aspects of smiles on person and expression perception was explored in combination with head-tilt and gender. One hundred participants were shown different types of smiles (slow versus fast onset) in combination with three forms of head-tilt (none, left, or right) exhibited by six computer-generated male and female encoders. The encoders were rated for perceived attractiveness, trustworthiness, dominance, and the smiles were rated for flirtatiousness and authenticity. Slow onset smiles led to more positive evaluations of the encoder and the smiles. Judgments were also significantly influenced by head-tilt and participant and encoder gender, demonstrating the combined effect of all three variables on expression and person perception.

Keywords Dynamics · Emotions · Facial expressions · Perception of emotions · Person perception

Introduction

The human face provides a rich source of dynamic information[1] that plays a key role in interpersonal communication. Much past research on the influence of temporal

[1] For practical reasons the terms 'dynamic' and 'temporal' will be used interchangeably and both refer to onset duration as manipulated in this research.

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information of facial activity has been concerned with the recognition of personal identity (Bassili, 1978; Bruce & Valentine, 1988; Knight & Johnston, 1997; Lander, Christie, & Bruce, 1999) and the identification or discrimination of emotional expressions (Wehrle, Kaiser, Schmidt, & Scherer, 2000; Kamachi et al., 2001; Ambadar, Schooler, & Cohn, 2005). A recognition advantage was shown for most studies when judges were shown moving facial sequences rather than static representations.

Very little work has addressed the influential role of dynamic information in the interpretation of a facial display, particularly with respect to the perceived authenticity of an expression. Sato and Yoshikawa (2004) investigated the effect of presentation velocity on the artificiality of morphed expressions of several emotions. However, their study appears to have been mainly aimed at determining whether an expression appears plausible, rather than whether it is a plausible but fake expression. A recent study by Krumhuber and Kappas (2005) systematically examined the impact of different onset, apex, and offset durations of smiles on the degree of perceived authenticity of those smiles. Onset duration refers to the length of time from the start of the smile until its maximum intensity, apex duration to the length of time before this maximum smile starts to decrease, and offset duration to the length of time from the end of the apex until the smile disappears. Smiles with longer onset and offset durations were judged as significantly more genuine than their shorter counterparts, whereas authenticity ratings decreased the longer the smile was held at the apex. These findings support the notion that dynamic properties play an important role in expression perception by conveying crucial information about the meaning of an expression to an observer.

The communicative value of dynamic information may, however, not be restricted to the perception and attribution of affective states; it may also have important implications for *person perception*. There is consistent evidence that smiling people attract more favorable personality ratings and are more likely to be ascribed positive traits, compared to their non-smiling counterparts (Mehrabian, 1969; Palmer & Simmons, 1995). Specifically, individuals who smile are rated as higher in kindness, sense of humor, and honesty (Thornton, 1943, as cited in Hess, Beaupré, & Cheung, 2002) and lower in dominance (Keating et al., 1981; Edinger & Patterson, 1983). Furthermore, smiling people are viewed as happier, warmer, more attractive, successful, intelligent, polite, sociable, and flirtatious (e.g., Lau, 1982; Moore, 1985; Muehlenhard, Koralewski, Andrews, & Burdick, 1986; Reis et al., 1990). Some researchers have examined the influence of different topographical forms of smiling on person perception. For example, Otta, Abrosio, and Hoshino (1996) and Otta, Lira, Delevati, Cesar, and Pires (1994) distinguished between closed, upper, and broad smiles and found a significant effect of smile type on ratings of happiness and leadership. Furthermore, Hess et al. (2002) cite unpublished work pointing to higher levels of affiliation and dominance ratings for moderate and strong smiles than for neutral expressions or miserable smiles. However, the impact of the different *temporal* forms of smiles on person perception has not yet been investigated. Given that facial expressions are moving rather than static displays, this seems to be an issue worthy of investigation. Minimal temporal changes in facial displays might be sufficient to shape the overall impression of a person.

In the research reported here we examined the effect of smile dynamics on person perception, i.e., trustworthiness, attractiveness, and dominance, and on the perceived quality of the smile expression, i.e., flirtatiousness and authenticity. For example, do

the temporal dynamics of smiles affect the perceived attractiveness and dominance of the stimulus character? Does the perceived trustworthiness of a person vary as a function of the perceived quality of a smile expression? The five dependent variables were selected as a subset of trait and expression items for which previous research had identified a powerful effect of smiling. The onset-phase of smiling was chosen as the experimental manipulation of smile dynamics because it has been shown to provide the 'initial and most conspicuous change in appearance of the face, as perceived by human observers' (Cohn & Schmidt, 2003, p58; see also Leonard, Voeller, & Kuldau, 1991; Schmidt, Cohn, & Tian, 2003). Two different onset durations (133 and 533 ms) were selected on the basis of our previous research (Krumhuber & Kappas, 2005) showing that smiles with longer onset durations were perceived as more genuine than their shorter counterparts. Generalizing from research comparing smiling with non-smiling faces, it was assumed that smiles with short onset durations would attract less positive personality ratings than their longer counterparts.

In the Krumhuber and Kappas (2005) study, the different dynamic features of smiling were represented by male stimulus faces. The generalizability of those findings to female faces is therefore unknown. A second objective of the present study was to examine whether the gender of the stimulus person influences the interpretation of smiles. Gender stereotypes and beliefs about emotional expressiveness suggest that different standards might be applied in evaluating the nonverbal behavior of men and women. In Western societies, the smile expression is both considered and observed to be more typical for women than men (Hess et al., 2000b). Women smile more than men and are also expected to do so (e.g., Briton & Hall, 1995; Hall, Carney, & Murphy, 2002; LaFrance, Hecht, & Levy Paluck, 2003). A failure to smile consequently leads to more negative evaluations of women than of men, as shown by Deutsch, LeBaron, and Fryer (1987). Moreover, given the general expectation that women smile more than men, their smiling expressions may even be discounted. That is, perceivers may not consider women's smiles to be informative because they are the expected baseline expression (Hess, Blairy, & Kleck, 2000a). In contrast, because men's smiles are less common, they may be seen to convey more information about the encoder's dispositions. Thus, the traits associated with smiling may be ascribed more readily to smiling men than women. In this sense, men's smiling may be counter-stereotypic behavior (Schmid Mast & Hall, 2004a) that leads to more 'correspondent inferences' (Deutsch et al., 1987, p343) and consequently the attribution of more smile-related characteristics. There is some evidence showing that men's smiles are rated as happier than are women's expressions (Shrout & Fiske, 1981). Controlling for facial appearance cues, Hess, Adams, and Kleck (2004, 2005) demonstrated that men's expressions of happiness were perceived as more intense than those of women.

The high-baseline level of women's smiles therefore may lead under certain circumstances to women's smiles to be discounted as a sign of trustworthiness. Supportive evidence for this notion comes from Bugental, Love, and Gianetto (1971), who showed that mothers' smiles indicate positive affect less reliably than do fathers' smiles, and are also seen by children as less informative about affiliative intentions. LaFrance and Hecht (2000) refer to unpublished work on married couples suggesting that wives display relatively more inauthentic smiles than husbands. However, the evidence for this is equivocal (see Halberstadt, Hayes, & Pike, 1988; Hecht & LaFrance, 1998; Hall, Carter, & Horgan, 2000). In the present research, the effect of gender was investigated with regard to the perceived attractiveness, trustworthiness, and dominance of the stimulus person; and the perceived flirtatiousness and

authenticity of smiles. The perception of smiles with short and long onset durations may vary as a function of encoder gender. Also, different gender-stereotypic attributes may be ascribed to smiling men and women.

A related question concerns possible gender differences in the *decoding* of smiles with long or short onset durations. Research on sexual intent and flirting behavior has shown that men are more likely than women to misperceive smile expressions as invitations to flirt, and fail to distinguish friendly from sexually laden behavior (e.g., Abbey, 1982, 1987; Abbey & Melby, 1986). This greater propensity of men to perceive behaviors as sexually motivated is particularly relevant when interpreting ambiguous behavioral stimuli (Henley, 1977; Kowalski, 1993). Moreover, there is considerable evidence that women are superior in the decoding of facial expression cues (e.g., Hall, 1984; Hall & Briton, 1993; Hall et al., 2000) and make more extreme judgment ratings than men (Katsikitis, Pilowsky, & Innes, 1997). Women's greater sensitivity to nonverbal signs and higher decoding ability therefore suggest that women may read smile dynamics in a more fine-tuned way than men do. Consequently, they may be more likely to use the extreme poles of the rating scale. For the present study, it was assumed that men's and women's perceptions would be differentially influenced by the temporal characteristics of smiles. Specifically, we thought that smiles with short onset durations would be more ambiguous with respect to their perceived intentional quality, such that the signal they convey would be more contradictory.[2] In consequence, when an ambiguous behavior such as a smile with short onset duration is displayed, men should be less sensitive to its dynamic properties and as a result attribute greater levels of flirtatiousness than women.

A third objective of the present research was to investigate the effect of sideways tilt of the head on person perception. Head canting has been shown to be a subtle determinant of impression formation. Not only does the emotional appeal of a target person change from proud, powerful, arrogant, and unsociable to kind, soft, dreamy, and thoughtful (Hirsbrunner, Frey, & Crawford, 1987), but also the meaning attributed to a smile expression has been found to differ as a function of lateral head-tilt (see Frey, Hirsbrunner, Florin, Daw, & Crawford, 1983; Frey, 1999). The impression created by the famous smile of the Mona Lisa changes when a lateral head-tilt toward the shoulder axis is created using image-manipulation techniques. Showing pictures in which her head was laterally tilted to the left of the vertical (i.e., the same direction as her glance) produced more pronounced effects of her smile than when her head was tilted in the opposite direction. Further evidence supports the notion that both the stimulus person's gender and the perceiver's gender moderate the impact of head canting (see Frey et al., 1983; Halberstadt & Saitta, 1987). In a study by Otta et al. (1994), greater levels of beauty, but lower levels of happiness, were attributed to a stimulus person with head tilted than to the same stimulus person with head upright. Interestingly, female encoders were judged to be less reliable with their head tilted, but this effect only emerged for female observers. Women, therefore, seemed to be more critical in their evaluations of other women's behavior. Moreover, women considered a male stimulus person with his head tilted to be more handsome. It may be that the head-tilt (just as with the smile) leads to

[2] Although authenticity and ambiguity may conceptually be two different constructs, as suggested by one of our reviewers, we assumed that they would overlap with respect to the dimension of degree of sexual connotation.

more correspondent inferences about males. Costa, Menzani, and Ricci-Bitti (2001), in an extensive evaluation of head-canting in paintings, found that lateral head flexion was significantly higher in female than in male figures. Lateral head-tilt may, consequently, evoke different attributions depending on whether the encoder is male or female. In sum, the expressive quality of the lateral head-tilt seems to be moderated by a host of factors and related to a number of independent variables. In relation to the present study, these findings suggest that head posture should play a role in the perception of the smile expression but that its effect might be moderated by the gender of the stimulus person. Especially when observers make dispositional attributions, such as trustworthiness, the effect of head tilt is likely to vary in male and female encoders.

To summarize, the present study was designed to investigate the effect of smile dynamics, gender and head-tilt on judgments of person and on expression perception. The simultaneous study of all three variables should prove valuable in exploring their individual and combined effects in shaping impressions. The literature review has shown that all of these components may be endowed with a number of meanings that are intricately linked with each other. Thus, the perceived meaning of the smile expression may not be fixed, but rather is likely to differ depending on the level of head-tilt and the gender of encoder and perceiver. In everyday social communication all three components jointly influence the way in which we perceive people and do not occur in isolation. The current work aims to investigate these interrelated processes. This calls for variables to be manipulated in a controlled, standardized fashion. We therefore elected to use computer-generated faces to permit systematic variation of the variables of interest. By using a graphics animation tool we were able to create sophisticated 3D-animations of facial movements that were believable and highly controlled.

The following hypotheses were tested. First, we predicted that the temporal dynamics of smiles would influence ratings of both person perception and the quality of the smile. Previous research findings showing that smiles with long onset durations were perceived as more genuine suggest that there should be a similar effect on overall person perception. Specifically, it was hypothesized that stimulus persons displaying a smile with a long onset duration would be perceived as more attractive, more trustworthy, and less dominant. Furthermore, these smiles should be judged as more flirtatious and less fake than smiles with a short onset duration. Second, it was predicted that the perception of slow and fast onset smiles would vary as a function of encoder gender. Due to the high-baseline level of female smiles, smiles in women are likely to be discounted as a sign of trustworthiness. In addition, different gender-stereotypic attributes should be ascribed to smiling men and women. Third, it was hypothesized that men's and women's perceptions would be differentially influenced by the temporal characteristics of smiles. This effect should be reflected in a significant interaction between smile dynamics and participant gender. Research on sexual intent and flirting behavior suggests that men are more likely than women to misperceive smile expressions as an invitation to flirt, and are less likely to distinguish friendly from sexually laden behavior. Significant gender differences were therefore expected in ratings of the flirtatiousness of smiles with a short onset duration. Furthermore, given women's greater nonverbal sensitivity, female participants should be more elaborate in their evaluations, making more extreme judgment ratings than men. Fourth, it was hypothesized that a sideways tilt of the head would significantly influence participants' ratings and lead to different perceptions

depending on the type of smile expression and the sex of the stimulus person, as suggested by previous literature. This effect should be particularly strong when making dispositional attributions.

Method

Participants

One hundred students (50 males and 50 females), aged 18–37 years (M = 22.9 years, SD = 4.1) at the University of Cambridge participated on a voluntarily basis and were paid £3.00.

Design

A four factorial design nested within encoder was employed with the within-subjects factors, gender of encoder (male/female), smile onset duration (short/long), head-tilt (no, left, right), and the between-subjects factor gender of participant (male/female). Two different onset durations crossed with three different head-tilts were exhibited by six male and six female encoders. The resulting 72 stimuli 12 (encoders) × 2 (onset durations) × 3 (head-tilts) were subdivided into sets of 12. Approximately the same number of participants responded to one of these sets that showed each encoder in a different stimulus combination of onset durations and head-tilt. The representation of encoders was balanced across these different stimulus combinations so that a given encoder was not seen more than once with any given combination of onset durations and head-tilt. The stimulus set was presented five times because ratings on five different dependent variables were made for each stimulus. Thus, there were 60 stimuli in each stimulus set, presented in a random order.

Stimulus Material

Stimuli consisted of synthetic faces generated using the Poser 4 (Curious Labs, Santa Cruz, CA, USA) character animation software. Six different male and female characters were created by altering the facial structure and type of hair of Poser figures supplied with the software package. Several adjustments were made to each character's face until they were clearly distinct in appearance and were judged to be realistic male and female characters, as determined in a pilot study (N = 16). Dynamic smile expression stimuli varying in head-tilt were synthesized by using standard morph targets in Poser 4 (morph targets: smile; side-side). The smile expression was operationally defined as an upper smile and involved a lip corner pull with a slight lifting of the cheeks together with an opening of the mouth. In terms of facial action coding system (FACS; Ekman & Friesen, 1978), it was classified by two FACS certified coders as a combination of Action Units 6 + 12 + 25. Three different static head-postures were selected: upright, tilted 8° to the right of the vertical; or tilted 8° to the left of the vertical. In discussion with colleagues, we chose this degree of head-tilt to achieve realistic, natural-looking head-tilts that would differ from the upright position. Examples of the stimuli are shown in Fig. 1.

Fig. 1 Three sample Poser male and female characters with right head-tilt, no head-tilt, and left head-tilt displaying a neutral facial expression (*top*) and an open-mouth smile (*bottom*)

For each Poser face, two smile expressions differing in onset duration were generated at a frame rate of 30 images per second. All stimuli started at a neutral position for ten frames and then changed linearly in one of two onset durations (133 or 533 ms) to a smiling face at a target intensity of 0.8. The 12 Poser models showing two different dynamic stimuli and three head-postures (which remained static) were rendered in color with the same viewpoint, camera focal length, and lighting. The resulting set of images measured 411 × 491 pixels and was displayed in random order on white background as movie-clips in Authorware Professional 7 (Macromedia). The animation clip for the two types of dynamic stimuli covered a time period of 40 frames (1.3 s).

Procedure

Participants arrived individually at the laboratory and were seated at one of three computer workstations that were visually isolated from each other in cubicles within the laboratory. Information was provided that participants would see a set of computer animated sequences of people displaying facial expressions. After signing a consent form, detailed instructions regarding the purpose of the study and the experimental task were presented using Authorware Professional 7. Participants were subsequently instructed in the use of the mouse to indicate their ratings and a practice trial was performed. The experimenter then answered any of the participants' remaining questions regarding the procedure and left the room. If any participants wished to discontinue the study, they were told that they were free to do so. None of the participants chose to withdraw. The stimulus sequence could be initiated by using the mouse to click a 'start' button on the computer screen. Each stimulus appeared for 1.3 s (40 frames) and was prefaced by a rating dimension that was displayed throughout the stimulus presentation. After the stimulus disappeared,

participants were instructed to respond to the judgment scale by indicating their answers. By clicking a 'Continue' button on the screen the next stimulus presentation could be initiated.

Dependent Variables

The following questions were answered on 7-point Likert-scales ranging from (1) *not at all* to (7) *very*: (a) How trustworthy is the person? (b) How attractive is the person? (c) How dominant is the person? (d) How fake is the expression?, and (e) How flirtatious is the expression? These questions were posed in a random order, with one question per stimulus presentation.

Results

A multivariate analysis of variance (MANOVA) with post hoc comparisons was used to explore the effects of onset duration, head-tilt, and encoder and participant gender on the five dependent variables. Simple effects analyses were performed where interactions were significant. All reported pairwise comparisons were conducted using the Sidak correction for an overall α-level of .05 (see Field, 2000).

Effects of Onset Duration

Consistent with expectations, a multivariate main effect was found for onset duration, $F(5, 94) = 12.38$, $p < 0.001$. Univariate tests showed significant main effects on ratings of trustworthiness, $F(1, 98) = 7.63$, $p < 0.01$, attractiveness, $F(1, 98) = 10.17$, $p < 0.01$, and dominance, $F(1, 98) = 5.72$, $p < 0.05$. Stimulus persons showing smiles with long onset durations were rated as more attractive, more trustworthy, and less dominant. In addition, significant main effects were revealed for ratings of how fake, $F(1, 98) = 36.50$, $p < 0.001$, and how flirtatious the smile was seen to be, $F(1, 98) = 32.99$, $p < 0.001$. Smiles with long onset durations were perceived as less fake and more flirtatious than were smiles with short onset durations. Total means and standard errors for the dependent variables are shown in Table 1.

Effects of Encoder Gender

A significant multivariate main effect emerged for encoder gender, $F(5, 94) = 13.91$, $p < 0.001$. Univariate tests yielded significant main effects for the following variables: attractive, $F(1, 98) = 4.30$, $p < 0.05$, dominant, $F(1, 98) = 18.59$, $p < 0.001$, fake, $F(1, 98) = 8.63$, $p < 0.01$, and flirtatious, $F(1, 98) = 20.21$, $p < 0.001$. In general, female encoders received higher attractiveness ratings ($M = 4.53$) than did male encoders ($M = 4.27$), whereas male encoders were rated as more dominant ($M = 4.06$) than their female counterparts ($M = 3.57$). This was shown to be the case regardless of the type of smile displayed, suggesting gender stereotypic effects in person attributions.

Furthermore, smiles displayed by women were seen as more fake ($M = 4.19$) than were those shown by men ($M = 3.82$), whereas participants judged men's smiles to be more flirtatious ($M = 4.18$) than women's smiles ($M = 3.71$). For ratings of

Table 1 Means and standard errors ($N = 100$) for dependent measures as a function of smile onset duration and gender of encoder

Measure	Encoder	Smile onset duration			
		Long		Short	
		M	*SE*	*M*	*SE*
Trustworthy	Male	4.33	0.1	4.23	0.1
	Female	4.40_{a}	0.1	4.01_{a}	0.1
	Total	4.36_{b}	0.08	4.12_{b}	0.07
Attractive	Male	4.55_{c}	0.11	3.99_{c}	0.11
	Female	4.49	0.08	4.57	0.11
	Total	4.52_{d}	0.07	4.28_{d}	0.08
Dominant	Male	4.02	0.1	4.11	0.1
	Female	3.4	0.1	3.74	0.11
	Total	3.71_{e}	0.07	3.92_{e}	0.08
Fake	Male	3.59_{f}	0.11	4.05_{f}	0.12
	Female	3.71_{g}	0.11	4.67_{g}	0.1
	Total	3.65_{h}	0.09	4.36_{h}	0.08
Flirtatious	Male	4.65_{i}	0.1	3.72_{i}	0.12
	Female	3.84	0.11	3.59	0.11
	Total	4.24_{j}	0.08	3.65_{j}	0.09

Note: All ratings were made on Likert scales from 1 to 7, with higher scores indicating greater levels of that dimension. Means within rows sharing a common subscript differ significantly at $p < 0.05$ or better

flirtatiousness only, a significant gender of encoder by gender of participant interaction was found, $F(1, 98) = 6.84$, $p < 0.05$. Inspection of the means shows that male smiles were rated as more flirtatious by female participants than by male participants ($M = 4.23$ vs. $M = 4.14$, respectively).

A significant multivariate interaction emerged between gender of encoder and onset duration, $F(5, 94) = 8.78$, $p < 0.001$. On a univariate level, this interaction was significant for the dependent measures trustworthy, $F(1, 98) = 6.16$, $p < 0.05$, attractive, $F(1, 98) = 21.31$, $p < 0.001$, fake, $F(1, 98) = 8.69$, $p < 0.01$, and flirtatious, $F(1, 98) = 18.73$, $p < 0.001$. Analyses of simple effects demonstrated that participants only differentiated between different temporal forms of smiles in male encoders when rating attractiveness and flirtatiousness. The means and standard errors for the interactions are presented in Table 1. No significant effects of onset duration were observed where the stimulus person was female, indicating that perceivers were insensitive to these subtle temporal differences in women's smiles. However, opposite results were found for the trustworthiness and authenticity measures. Simple effects analyses showed a tendency for participants to differentiate more between smiles with long and short onset durations when the stimulus person was female. This suggests that female encoders were evaluated more critically with respect to the sincerity of their expression. The finding that smiles in women were rated as generally more fake than male smiles may help to account for this effect.

Furthermore, a significant multivariate gender of encoder by head-tilt interaction was obtained, $F(10, 89) = 3.82$, $p < 0.001$. It was univariately significant for ratings of trustworthiness, $F(2, 196) = 4.54$, $p < 0.05$, and dominance, $F(2, 196) = 9.54$, $p < 0.001$. Analysis of simple effects revealed a similar pattern to that described above. Again, a significant effect of head-tilt was only observed for female encoders. That is, when judging how trustworthy and dominant the stimulus persons appeared

to be, perceivers only distinguished between different levels of head-tilt in female encoders (trustworthy: left-right tilt: $p < 0.001$, no-right tilt: $p < 0.01$; dominant: left-right tilt: $p < 0.001$, no-left tilt: $p < 0.05$).

In addition, a significant multivariate onset duration by head-tilt by encoder gender interaction effect emerged, $F(10, 89) = 10.38$, $p < 0.001$. It was univariately significant for all five dependent measures: trustworthiness, $F(2, 196) = 8.44$, $p < 0.001$, attractiveness, $F(2, 196) = 18.50$, $p < 0.001$, dominance, $F(2, 196) = 5.69$, $p < 0.01$, authenticity, $F(2, 196) = 11.57$, $p < 0.001$, and flirtatiousness $F(2, 196) = 10.46$, $p < 0.001$. Although there was no consistent pattern across the variables, these triple interactions show that head-tilt and the gender of the stimulus person subtly moderated the implication of smile dynamics for person attributions.

Effects of Head-tilt

A multivariate main effect was obtained for head-tilt, $F(10, 89) = 4.31$, $p < 0.001$. Univariate tests showed a significant main effect on two dependent measures: trustworthiness, $F(2, 196) = 5.52$, $p < 0.01$, and attractiveness, $F(2, 196) = 15.06$, $p < 0.001$. Pairwise comparisons showed that stimulus persons with a right head-tilt were perceived as significantly more trustworthy ($M = 4.42$) than those with no ($M = 4.16$, $p < 0.05$) or left head-tilt ($M = 4.14$, $p < 0.05$). Opposite results were found for attractiveness. Here, stimulus persons with a left head-tilt were rated as more attractive ($M = 4.65$) than those with a right ($M = 4.41$, $p < 0.05$) or no head-tilt ($M = 4.14$, $p < 0.001$).

In addition, the MANOVA revealed a significant multivariate interaction between onset duration and head-tilt, $F(10, 89) = 3.74$, $p < 0.001$. On a univariate level it was significant for ratings of trustworthiness, $F(2, 196) = 5.93$, $p < 0.01$, and flirtatiousness, $F(2, 196) = 4.17$, $p < 0.05$. Simple effects analyses demonstrated that onset duration had a significant effect at each level of head-tilt on ratings of how flirtatious the smile appeared to be ($p < 0.05$), and also had a significant effect at two levels of head-tilt (no, right) on perceived trustworthiness ($p < 0.01$). That is, depending on the type of head-tilt, smiles with long onset durations were judged differently from those with short onset durations when making trustworthiness and flirtatiousness attributions. This suggests that head-tilt functioned as a subtle moderator in the perceived authenticity of smiles.

Gender of Participant Effects

There was no significant main effect of participant gender, $F(5, 94) = .87$, $p > 0.05$. However, a significant multivariate interaction between onset duration and participant gender emerged, $F(5, 94) = 3.69$, $p < 0.01$. It was univariately significant for most dependent measures: trustworthiness, $F(1, 98) = 4.65$, $p < 0.05$, attractiveness, $F(1, 98) = 3.97$, $p < 0.05$, authenticity, $F(1, 98) = 17.00$, $p < 0.001$, and flirtatiousness, $F(1, 98) = 4.31$, $p < 0.05$. As predicted, female participants were more likely to use the extremes of the rating scale than were male participants (see Table 2). Significant gender differences were revealed for both temporal forms of smiles with respect to perceived smile authenticity. Follow-up simple effects analyses showed that women judged smiles with short onset durations as significantly more fake than men did, $t(98) = 3.58$, $p < 0.01$. Similarly, smiles with

Table 2 Male and female participants' mean scores as a function of smile onset duration

Measure	Smile Onset Duration			
	Long		Short	
	Males	Females	Males	Females
Trustworthy	4.22 (0.11)	4.51 (0.11)	4.16 (0.1)	4.08 (0.1)
Attractive	4.42 (0.1)	4.62 (0.1)	4.33 (0.12)	4.23 (0.12)
Dominant	3.76 (0.1)	3.66 (0.1)	3.93 (0.11)	3.91 (0.11)
Fake	3.85_a (0.13)	3.45_a (0.13)	4.08_b (0.11)	4.64_b (0.11)
Flirtatious	4.23 (0.11)	4.26 (0.11)	3.85_c (0.13)	3.46_c (0.13)

Note: All ratings were made on Likert-scales from 1 to 7, with higher scores indicating greater levels of that dimension. Means within rows sharing subscripts a and c differ significantly at $p < 0.05$; means within rows sharing subcript b differ significantly at $p < 0.01$. Standard errors are in parentheses

long onset durations were rated as significantly less fake (i.e., more genuine) by women than by men, $t(98) = -2.22$, $p < 0.05$. Furthermore, a significant gender difference was shown with respect to flirtatiousness ratings. This gender effect only reached statistical significance for smiles with short onset durations, $t(98) = -2.10$, $p < 0.05$. That is, male and female participants differed significantly in their ratings of the flirtatiousness of smiles with short onset durations, but not with respect to the flirtatiousness of smiles with long onset durations. This suggests that men and women were differentially sensitive to the temporal quality of smiles when attributing sexual meaning, i.e., the degree of flirtatiousness, to a behavior.

In addition, a significant multivariate interaction between gender of participant and head-tilt was obtained, $F(10, 89) = 2.25$, $p < 0.05$. It was univariately significant for ratings of flirtatiousness, $F(2, 196) = 4.03$, $p < 0.05$. Simple effects analyses showed that only female participants distinguished between different levels of head-tilt. They attributed lower levels of flirtatiousness when no head-tilt was shown ($M = 3.64$) compared to when the head was tilted to the left ($M = 3.9$, $p < 0.05$) or to the right ($M = 4.03$, $p < 0.01$).

Relationship between the Rating Scales

Correlational analyses were performed to examine the relationship between the five dependent variables. As seen in Table 3, attractiveness ratings were significantly and positively correlated with trustworthiness and dominance ratings. The more attractive a stimulus person was judged to be, the more trustworthy and dominant he or she appeared to be. In addition, a significant but negative relationship was found between perceived trustworthiness and inauthenticity. To the degree that participants judged an encoder as trustworthy, they were also less likely to perceive his or her smile expression as fake. No significant correlation was observed between ratings of attractiveness and smile inauthenticity. Furthermore, partial correlations of trustworthiness with smile inauthenticity confirmed that this relationship remained

Table 3 Pearson's correlations between dependent measures

Dependent measure	Dependent measure			
	Attractive	Dominant	Fake	Flirtatious
Trustworthy	0.34***	–0.12	–0.35***	0.15
Attractive		0.29**	–0.17	0.18
Dominant			0.09	0.21*
Fake				0.08

*$p < 0.05$

**$p < 0.01$

***$p < 0.001$, two-tailed

significant when controlling for attractiveness ($r = –0.33$, $p = 0.001$). Dominance ratings were weakly related to flirtatiousness ratings.

Discussion

The goal of the present study was to explore the effect of smile onset duration in combination with head-tilt and encoder gender on how both the encoder and the expression are perceived. The results provide new insights into the signal value of dynamic information when it is embedded in the context of other communicative cues. There was a powerful effect of onset duration on all person perception ratings and on judgments of the quality of the smile expression. Stimulus persons displaying a smile with a long onset duration were rated as more attractive, more trustworthy, and less dominant than were persons showing a smile with a short onset duration. Furthermore, smiles with long onset durations were judged to be more flirtatious and more authentic, thereby replicating previous findings (Krumhuber & Kappas, 2005). These results highlight the importance of dynamic properties in the perception of both the stimulus person and the expression. In past research, the communicative function of smile dynamics has only been demonstrated with regard to expression perception per se. The current study therefore provides initial evidence that smile dynamics also contribute to judgments of the personality of the encoder. A smile does not have a single meaning for an observer. Different temporal forms of smiles give rise to different judgments, both of the expression and of the person.

The gender of the stimulus person was shown to significantly influence judgments. In general, female encoders were rated as more attractive than were male encoders, whereas male target persons attracted higher dominance ratings than did their female counterparts. No baseline measure of attractiveness or dominance was taken, so we cannot rule out the possibility that male and female targets differed with respect to actual attractiveness and dominance. The results nevertheless suggest that such ratings are determined, in part, by gender stereotypic beliefs concerning the importance of attractiveness and dominance in men and women. Similar findings have been reported by Adams, Kleck, Hess, and Wallbott (2004), Algoe (2000), Halberstadt and Saitta (1987), and Mignault and Chaudhuri (2003) for dominance; and by Downs and Harrison (1985), Eagly, Ashmore, Makhijani, and Longo (1991), Langlois et al. (2000), and Reis et al. (1990) for attractiveness. In addition, Hess et al. (2005) found higher ratings of attractiveness for women and dominance for men

even when androgynous faces (equally masculine and feminine in appearance) were employed as stimulus material.

A particularly interesting finding is that smiles shown by female encoders were judged as less authentic than were those displayed by men, whereas men's smiles were seen as more flirtatious than women's smiles. These findings can be explained by drawing on correspondent inference theory (Jones & Davis, 1965), which leads one to predict that the gender of a person gives rise to category-based expectations that alter the informational value of a particular behavior (Deutsch et al., 1987). That is, given the prevalent expectation that women smile more than men, perceivers may not consider such an expression to be informative because it is the expected expression (see Hess et al., 2000a). Smiles in women may therefore be discounted. Women's smiles were even judged to be indicative of less truthfulness in the present research. In contrast, because men smile relatively less often, male smiles may represent out-of-role behavior and observers in this study may have been led to draw more correspondent inferences and to make higher ratings of flirtatiousness on the basis of male smiles.

The notion that women's smiles do not convey unique information about their characteristics has been used to account for findings that female smiles are perceived as less authentic (Bugental et al., 1971; LaFrance & Hecht, 2000). However, previous research has not specified the ways in which women's smiles fail to convey information. On the basis of unexpected but intriguing findings, the present research suggests that this is closely linked to gender role. Participants were only insensitive to the dynamic properties of female smiles when making attractiveness and flirtatiousness ratings. It can be argued that behavioral cues like subtle temporal differences were not considered to be informative because attractiveness and flirtatiousness are stereotypically associated with women (see Abbey, 1982). Smile dynamics may therefore not have conveyed much information with regard to these gender stereotypic characteristics.

In contrast, when making trustworthiness and authenticity ratings participants took the dynamic properties of female encoders' smiles into account. The generally lower perceived authenticity of women's smiles suggests that observers were more likely to be critical when evaluating women. In this context, behavioral cues like the smile dynamics were considered to be informative when rating the sincerity of the expression and the trustworthiness of the person. These findings suggest that the informativeness of a given behavior varies with the type of attribute being judged. Supportive evidence comes from Schmid Mast and Hall (2004b) who showed that when assessing status (a characteristic more stereotypically associated with men), perceivers were particularly sensitive to appearance cues in men, whereas observers focused on behavior when assessing women. Observers may therefore use different cues depending on the domain specificity of attributes (male/female) being judged. In future research it would be worth including further dependent measures in order to assess whether the present findings generalize to other category-based expectations.

Head-tilt was found to influence attractiveness and trustworthiness ratings. Greater levels of attractiveness were attributed to stimulus persons with a tilted rather than upright head. These findings are consistent with those of Otta et al. (1994) and Costa and Ricci-Bitti (2000), and confirm the role of head canting in the perception of attractiveness and beauty. Surprisingly, opposite effects were found for ratings of trustworthiness and attractiveness as a function of whether the head was shifted to the left or right. This is interesting in that directionality of lateral head

flexion has only been investigated in past research in relation to gaze behavior or the presence of an interaction partner. Persons tilting their head toward a partner or in the direction of eye orientation were described more positively (friendly, honest, and kind) than were figures with heads tilted in the opposite direction (see Frey et al., 1983; Frey, 1999). The present results suggest that direction of head-tilt in itself leads to different (positive) attributions, independent of interaction partner or the eye orientation. An issue for future research would be to study the effects of left and right head-tilt independently of the perceived quality of interpersonal relationships and gaze behavior.

Surprisingly, head-tilt only influenced the perception of two attributes. This may be due to the fact that the selected angle of head tilt (8°) was relatively small. Costa et al. (2001), for example, reported a mean level of head canting in religious and modern paintings ranging from 20° to 80°. In Otta et al.'s (1994) study of the effects of head canting and smiling, stimulus persons showed a lateral head flexion of 45°. The impact of a head tilt of 8° may therefore have been restricted with regard to the number of associated attributes. An interesting finding is that participants only made different trustworthiness and dominance ratings as a function of lateral head-tilt for female encoders. This may again reflect the fact that participants were particularly sensitive to nonverbal behavioral cues when evaluating the sincerity of women and when ascribing non-stereotypical characteristics such as dominance.

Head canting has been reported more often for women than for men (Costa et al., 2001; Hirsbrunner et al., 1987; Ragan, 1982). Moreover, Otta et al. (1994) demonstrated that female encoders with heads tilted were perceived as less reliable. Lateral head flexion therefore seems to play a role in the attribution of trustworthiness. Furthermore, it also seems to moderate the influence of smile dynamics. In the present research, smiles with long onset durations were judged differently from smiles with short onset durations with respect to trustworthiness and flirtatiousness as a function of level of head-tilt. These findings show that head canting can function as a subtle moderator that shapes the meaning of the expression, and suggest that it is more likely to do so for women than for men.

In the research reported here, men's and women's ratings of the stimulus person were differentially influenced by the dynamic properties of smiles. The tendency of women to be more likely to use the extreme poles of the rating scale has been found in several studies (e.g., Otta et al., 1994, 1996; Katsikitis et al., 1997) and reflects the fact that the main effect of smile dynamics was mainly due to ratings made by female participants. The finding that women distinguished significantly more than men between smiles with short and long onset durations when rating the authenticity of the expression is consistent with the finding that women are superior in the decoding of nonverbal cues of emotion (Hall, 1984). Interestingly, men only differed from women with respect to how flirtatiousness a smile was judged to be when the smile had a short onset duration. Previous research on sexual intent has suggested that men are less sensitive than women when making attributions of sexual intent (e.g., Abbey, 1982, 1987; Abbey & Melby, 1986), especially when the behavior is ambiguous (Henley, 1977; Kowalski, 1993). Thus they are inclined to attach sexual meaning to behaviors regardless of the quality of the available cues. The smile with short onset duration used in the present study, which was perceived as less authentic, may constitute such an ambiguous stimulus. Men's tendency to pay less attention to this subtle temporal cue and to attribute greater levels of flirtatiousness than women provides further evidence of gender differences in perceptions of sexual intent.

Although the present study was successful in achieving its goals, it has certain limitations. One objection that can be raised against studies of this kind concerns the lack of naturalness of the stimuli. Synthesized facial images were employed in the current work in order to create different forms of smiling. The nature of the stimulus material may pose a constraint as far as the generalizability of the results to real faces is concerned. In this sense, judgments made in relation to synthetic faces may be different from those made in relation to real people. However, it is worth noting that we have shown similar impression effects in a recent study comparing synthetic with human faces (Krumhuber, Cosker, Manstead, Marshall, & Rosin, 2005). For both types of stimuli, the dynamic aspects of smiles led to similar judgements of person and expression. Furthermore, Bente, Krämer, Petersen, and de Ruiter (2001) demonstrated a high degree of correspondence between person perception made on the basis of standard video recordings and on the basis of computer animations. From these findings it appears that comparable responses are given across these two different modalities of presentation. Future research could nevertheless examine whether the specific effects of smile dynamics, head-tilt, and gender observed here are also obtained with more naturalistic stimulus material. Another limitation of the present research is that only the onset duration of smiles was varied. Further research could investigate the influence of other temporal features of smiles. Do the apex and offset phases of a smile also influence perceptions of personality attributes? And how do these different temporal variables combine to influence person perception?

Conclusion

The present study demonstrates the influence of duration of the smile onset, degree and direction of head-tilt, and encoder gender on judgments of encoder and of smiles. All three factors influenced participants' perceptions of the quality of the smile and their judgments of the encoder. These findings have implications for our understanding of how nonverbal cues influence the attribution of personality characteristics, and enhance our knowledge of how temporal features of smiles affect person and expression perception. They also extend previous data on the role played by dynamic information in the perception and recognition of facial expressions of emotions. Although long onset smiles were generally seen as more authentic and gave rise to more positive personality ratings than did short onset smiles, the influence of smile onset duration was moderated by head-tilt, gender of encoder, and gender of judge. This underscores the importance of examining how these and other factors interact in shaping person perception (see Zebrowitz & Collins, 1997). This, in turn, depends on first identifying and studying the key nonverbal variables in a controlled, experimental fashion. The manipulation of the three factors studied here can be seen as an important step. By studying each component systematically, their separate and joint influences can be determined.

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