Type A Behavior Pattern: Facial Behavior and Speech Components

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Early descriptions of the Type A coronary-prone pattern include both nonverbal and motoric signs. Facial behaviors during the Type A Structured Interview of 24 Type A and 24 Type B men were examined using the Facial Action Coding System. In addition, speech components and heart rate reactivity during the Structured Interviews were examined. Among the facial behaviors assessed, two significantly differentiated Type As from Type Bs: Glare and Disgust. The Glare and Disgust facial scores correlated significantly with a number of speech components, most notably Hostility, which has been found to be associated with CHD incidence in other research. No differences between the two behavior types were found for heart rate reactivity. Implications of the findings for the understanding and assessment of coronary-prone behaviors such as hostility are discussed.

INTRODUCTION

The behavioral components comprising the Type A coronary-prone pattern have been receiving increased attention in recent years. For the most part, these studies have concentrated on such components conveyed in speech reflecting competitive, aggressive, or hostile attitudes, and a sense of time urgency. However, as originally described by Rosenman et al. (1), Type A behavior is also marked by nonverbal or motoric signs including "facial grimaces, scowls, teeth-clenching, and tic in which teeth are clenched and masseter muscles are tensed (p. 2)." The purpose of this study was to examine facial behaviors as components of the Type A behavior pattern.

The leading procedure for assessing Type A behavior is the Structured Interview (SI), which consists of 26 questions about the subject's characteristic responses to a variety of common situations that have the potential to elicit competitiveness, irritation, and impatience (2, 3). Typically, judges classify subjects as Type A or Type B based on the content and speech stylistics of the subjects' interview responses (2). However, in describing the use of the SI to assess Type A behavior, Rosenman (2) also drew attention to the facial characteristics of the Type A as being "extraordinarily alert; that is, his eyes are very much alive, more quickly seeking to take in the situation at a glance. He may employ a tense, teeth-clenching and jaw-grinding posture. His smile has a lateral extension rather than an oval. . .one senses that there is a set type of hostility in the face, mostly evidenced

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by the eyes." Consistent with this description, ratings of the behavior pattern in the Western Collaborative Group Study (WCGS), (the primary study demonstrating the relationship of Type A behavior to coronary heart disease incidence) were based on both a checklist of interviewer's observations of each subject's nonverbal behaviors, including facial tension and lateral smiling, and the audiotape-recorded speech behavior (1). Thus, while facial and other nonverbal behaviors were considered originally to be an integral part of the behavior pattern, they have not been included in rating the global behavior pattern since the WCGS.

The evidence that Type A behavior is a coronary heart disease (CHD) risk factor derives from prospective, population-based studies showing that, controlling for standard risk factors, subjects exhibiting Type A behavior are more likely to develop clinical CHD than subjects exhibiting the converse, Type B behavior pattern (4–6). Additional evidence is provided by studies examining the relationship of Type A behavior to severity of coronary artery disease determined by autopsy (7) and angiography (8–10). Not all studies of the association between Type A behavior and CHD endpoints have been confirmatory (11–15). One of the explanations of the failure to observe a relationship is that the assessment of the behavior pattern lacks precision (16). This has prompted recommendations that studies "measure individual Type A behaviors, particularly hostility and anger-expression, as well as global Type A. . ." (p. 956) (17, 18).

Investigators have attempted to provide more objective measurements of Type A behavior by coding components of the behavior pattern based on speech stylistics (19–23). In a component reassessment of the interviews from the WCGS, hostility, competitiveness, speaking rate, immediateness, and Type A content were found to be significantly related to CHD incidence at the 8.5-year follow-up (21), and both CHD and cancer mortality at a 22-year follow-up (22). Among these predictive components, only hostility remained a significant risk factor when all the other Type A components scored were included in a multivariate analysis (23). In the Multiple Risk Factor Intervention Trial, ratings of stylistic hostility in Type A interviews have been found to be independently associated with increased CHD incidence, while global Type A behavior failed to show such a relationship (24).

Efforts to develop objective measurements of Type A behavior have also included nonverbal behaviors. Blumenthal et al. (25) scored movement of the arms, legs, hands, and feet or positional changes during Structured Interviews given on two occasions 4 months apart. Although this summary measurement of movement was found to be stable, it did not distinguish between Type A and Type B subjects. Heller (26) scored hand movement during the SI and found significant differences between Type As and Type Bs in the frequency per minute of those hand movements that accompany speech. However, when the effect of speaking rate was taken into account, the differences were no longer significant. Friedman et al. (27) proposed subgrouping Type As and Type Bs on the basis of verbal and nonverbal behaviors, and certain personality characteristics. They found that Type As who had high scores on a defensive-hostility factor (based on such nonverbal behaviors as fist making, postural shifts, and emphatic gestures) had more missing peripheral pulses than Type As who had low scores on this factor. This difference was discussed as a possible indication of peripheral vascular disease in the former group of Type As.

Facial behaviors received particular attention in a prospective study of postmyocardial-infarction patients. For that study, Friedman and Powell (28) developed a protocol for scoring the SI which included seven facial behaviors: eye contact breaks; eye blinks; eyebrow lifts; brow knits; mouth corner back grimace, head emphasis movements; facial tautness suggesting emotions, as indicated by horizontal forehead furrows; facial tautness suggesting hostility as indicated by vertical furrows between the brows and or tight lip muscles. Powell and Thoresen (29) found that head emphasis movements, muscle tension in the eyes and eyebrow lifts were significant predictors of recurrent CHD in univariate analyses. However, when these nonverbal indices were examined in multivariate analyses with other behavioral variables, the nonverbal behaviors were no longer significant.

The rationale for measuring facial behavior in the study of Type A behavior goes beyond these observations about specific facial behavior. Aggressiveness (30), hostile feelings (1), potential for hostility (24), and anger (29) are central affective qualities said to characterize Type A individuals. While these qualities are manifest in a variety of behavioral modes, facial expression is considered by many theorists to be the central signal system for emotion (31–34). Moreover, cross cultural research has established biologically based, universal facial expressions relevant to these affective states (see 35 for a recent review of the evidence). Type A research would suggest that anger expressions should be more frequent in Type A individuals but so also might disgust and contempt facial expressions, which are considered by most emotion theorists (e.g., 31, 32, 34) to be related to aggressiveness and hostility.

Despite this rationale for examining facial behavior, no study of Type A individuals has systematically measured all of the possible signs noted in the literature, let alone all of the facial expressions related to hostility. One impediment for such work is that some of the hypothesized facial signs are described too vaguely to allow objective measurement. Perhaps more importantly, precise techniques for comprehensively and objectively measuring observable facial behavior have become available only in the last 10 years (see 36 for a review), and their use requires highly specialized training. The rationale for our collaboration was to combine strategies in facial measurement of Ekman and Friesen (37, 38) with the assessment of Type A behavior of Chesney, et al. (21) thereby allowing comprehensive study of the range of facial expressions which might be diagnostic of the Type A behavior pattern.

The present study evaluated whether there are facial behaviors characteristic of the Type A behavior pattern. Facial movements during the SI were measured using techniques based on Ekman and Friesen's Facial Action Coding System (37, 38). In addition, the SI was coded for speech components so that the relationship between facial behavior and speech could be examined. Finally, heart rate during the SI was assessed so that relationships among facial behaviors, Type A behavior pattern, and cardiac activity could be examined.

METHOD

Subjects

Subjects were 48 male salaried employees in predominantly managerial positions at an aerospace firm in the San Francisco Bay Area (mean age 50.6 years). These subjects had participated in a study of work-related stress 4 years before the present study and none had a history of heart disease. They were selected from a larger sample of 85 males on the basis of their classifications as Type A or Type B according to the SI, which was administered following the procedure described below. These interviews were rated independently by three judges using the five-point scale (A1, A2, X, B3, and B4). The ratings were performed using audiotape recordings of the SI by judges who were blind to the facial and heart rate data. Using these ratings, the subjects were rank-ordered from subjects rated by all three judges as Al to those rated by all three judges as B4. The upper 24 were designated Type A and the lower 24, Type B. In addition to this ranking procedure, subjects were assigned Type A or Type B ratings based on a majority rule, i.e., two of the three judges in agreement that the subject was Type A (A1 or A2) or Type B (B3 or B4). In cases where there was no majority rating, the three judges met and arrived at a consensus. These majority or consensus ratings were compared with the rankings. All of the upper 24 subjects had been rated Type A and all of the lower 24 subjects had been rated Type B.

Procedure

After a resting baseline period of 6 minutes, subjects were administered the SI by an interviewer trained in administration of the Type A interview. Electrocardiographic (ECG) data were collected throughout the interview by ECG electrodes taped over the subjects' right clavicle and lowest left rib. ECG data were recorded on a Beckman polygraph Model R-511A and an Ampex FM recorder.

Subjects' interviews were audiotaped using a Nakamichi Model 550 recorder with a remote Sony ECM-50 microphone, and videotaped using a Sony Model SL0323 recorder. All recordings were given time designations for later correspondence by a Systron-Donner time code generator Model 8152.

Heart rate was scored by a MINC DECLAB computer using interbeat intervals on the ECG. Baseline heart rate was scored as the mean heart rate during the 6th minute of the baseline period. Heart rate responsivity was calculated as the difference between the mean heart rate during the SI and the mean heart rate during the baseline period. The cumulative frequency distribution of heart rate during the SI was derived for each subject and heart rate variability computed as the difference between the 90th- and 50th-percentile heart rates.

Facial Measurement

Facial movements were measured from the videotaped SI recordings for each subject using Ekman and Friesen's Facial Action Coding System (FACS) (37, 38). This is an anatomically based, comprehensive, objective technique for measuring all observable facial movement. With this system, trained scorers decomposed all facial expressions occurring during the SI into their elemental muscular actions when any one of 33 predefined combinations of facial actions are observed. These 33 combinations of facial actions include all of the facial configurations that have been established empirically (35, 38) to signal the seven emotions that have universal expressions: anger, fear, disgust, sadness, happiness, contempt, and surprise. FACS scoring is performed, however, in descriptive behavioral terms, rather than making inferences about these underlying emotional states. The scores for a particular expression consist of the list of muscular actions that are determined to have produced it. Repeated viewing of the videotaped record is necessary for scoring and to evaluate interscorer agreement.

The facial muscular scores obtained are then converted by a computer dictionary into emotion scores. While the dictionary was originally based on empirical theory, research has since provided evidence for the validity of the facial action patterns. This includes cross-cultural studies (35), correlations with reports of subjective experience and differentiation of specific patterns of physiological activity co-occurring with specific expressions (39, 40).

For the present study, the videotaped SIs were randomly assigned to two experienced scorers who had either 1 or 4 years of experience measuring facial behavior and who had shown interscorer reliability estimates exceeding 0.80 for FACS scores prior to their scoring the videotapes for this study. These scorers did not know whether the subjects had been classified as Type A or Type B, and were unfamiliar with the literature about Type A behavior. The scoring was performed on the videotapes without sound.

Scores were obtained on the frequency of seven single emotions (anger, fear, disgust, sadness, happiness, contempt, and surprise) and the co-occurrence of two or more of these emotions in blends. Because the incidence of Fear and Sad scores was quite low, these two nonhostile, negative emotions were also combined into a single category of Fear plus Sad, in addition to considering them separately. The dictionary also provides a distinction between enjoyment smiles and other smiles not related to feelings of enjoyment. Enjoyment smiles are presumed to have been made involuntarily and have been found to be associated with the subjective experience of positive affect and associated physiological changes (35, 40). Alternatively, other smiles are presumed to have been made voluntarily, and have been found not to be associated with positive affect nor with physiological changes unique to enjoyment.

Specific combinations of facial actions that were suggested by the literature on facial expression and Type A behavior were also scored. Table 1 lists the observations about facial expressions found in the literature on Type A behavior, the relevant facial behavior that was scored, and how that behavior is interpreted by FACS, based on facial expression literature. Items 1 through 4 in Table 1 are separate elements of what together comprise an anger expression (35, 38). Singly they are ambiguous: they may be signals of anger that is being inhibited or censored; or they may be quite unrelated to anger. For example, teeth clenching (item 3) occurs as a mannerism or when a person is attempting to inhibit the vocal expression of any emotion, whether it be fear, distress, disgust, or anger. The lowered brow (item 1) and the tightened lower eyelid (item 2) may occur when a person is thinking or concentrating, or if the person is having difficulty understanding what someone else is saying or having difficulty determining what to say next (41). Usually when these actions signal such cognitive activity, the person also gazes away from the interviewer. To focus on actions that might be more relevant to hostility and not signs of cognitive activity, only those instances of items 1

TABLE 1. Correspondence Between Facial Signs from the Type A Literature and FACS

Facial Sign from Type A Literature	Relevant Facial Activity Scored	Interpretation from Facial Expression Literature
1. Scowl, brow knit, vertical furrows between brows	Brow lowered and pulled together by corrugator muscle	Anger, if accompanied by upper eyelid raise and/or tightened lower eyelid and/or pressed or tightened lips
2. Hostility in the eyes	Upper lid raised by upper lid levator and lower lid tightened by orbicularis oculi pars palebralis muscles	Anger, if brow lowered and/or lips pressed or tightened
3. Teeth-clenched, masseter muscle tensed	Bulge at mandible produced by masseter muscle	Can occur with anger, or attempts to control any emotion
4. Tight lips	Tightened lips by inner strands of orbicularis oris muscle	Possible anger
5. Lateral smile, mouth corner back, grimace	Lip corners pulled up and/or stretched horizontally by zygomatic major and/or risorious muscles	Happy and/or possible fear
6. Brow raise or lift horizontal forehead	Brow raise and horizontal forehead furrows are produced by the frontalis muscle	Surprise only if accompanied by upper eyelid raise and/or jaw dropped open

and 2 in which the subject was looking toward the interviewer were considered. Since they involve actions in the same region of the face and subject to the same interpretation, we combined items 1 and 2 into a single score which we refer to as Glare in which the brows are lowered, the upper eyelid is raised and/or the lower eyes are tensed, and the gaze is directed at the other person.

Speech Component Measurement

A component scoring procedure was used to assess Type A components from subjects speech stylistics and content during the audiotaped interviews. A detailed description of this procedure is presented elsewhere (21). This procedure involves the division of the SI into 20 segments. Each segment begins with one of 20 key questions in the interview and includes all of the subjects' responses to the key question and all subsequent dialogue until the next key question is asked. In this manner, all of the subjects' speech during the interview were scored, including speech that coincided with that of the interviewer. The subjects' speech stylistics and content were scored in terms of 12 operationally defined components. Previously described facets of the Type A behavior pattern (1), as well as other variables thought to be related to CHD risk comprised the behaviors that were measured using this procedure.

The recorded interviews were played back three times in order to complete an assessment of the components. Each component was given a score on a five-point scale for each interview segment or set of segments (from 0 to 4) This score indicated the extent to which a given component behavior was present during the SI. Scores were summed for each component across the interview segments and the total score was used in analyses. The speech components of the SIs were coded by one of the authors (MHLH) and originators of the speech component scoring procedure. This scoring was done without knowledge of the subject's classification as Type A or Type B.

Statistical Analysis

Preliminary examination of the data revealed that the distributions of FACS scores were highly skewed and that the variance of FACS scores within Type A and Type B groups was related to the means for those groups. For this reason it was decided to use nonparametric statistical tests in the data analysis instead of the classical methods. In particular, the Wilcoxon-Mann-Whitney test based on the ranks of the data was used to compare Type As and Type Bs on FACS scores. The Wilcoxon-Mann-Whitney test was also used to compare Type As and Type Bs on speech component scores. This test provides a t-statistic which then was used in conjunction with the usual published tables for the t-distribution. Residuals from a regression of FACS scores on speech component scores were used for a Wilcoxon-Mann Whitney test to compare Type As and Type Bs on FACS scores adjusted for speech component scores. Spearman rank-order correlations were used to assess the association of cardiovascular measures with FACS and speech component scores.

RESULTS

Means for the FACS scores for Type As and Type Bs are shown in Table 2. Type A subjects were found to have significantly higher scores on Glare and Disgust than Type Bs. Means on the speech components for Type As and Type Bs are presented in Table 3. Significant differences were found between the two behavior types on each of the components with the exception of Exactingness (i.e., attention to detail). The significant differences observed were in the expected direction, i.e., Type As expressed more of every component except Despondency, which is more characteristic of Type B speech behavior (21). It is important to note that the classification of subjects as Type A or Type B is based on global clinical ratings of the speech stylistics and content on audiotape recordings of the SI. Thus, the correlation between the speech components and global ratings are likely to be inflated due to common method variance. The largest differences between Type As and Type Bs were observed for Syllabic Emphasis, Loudness of Voice, Hostility, and Speaking Rate.

TABLE 2. FACS Percentile Scores for Type As and Type Bs

Behavior Type	Type A		Type B		t	p*
	X	SD	X	SD		
Facial Components						
Disgust	59.9	27.8	40.1	25.3	2.57	0.01
Fear & Sad	56.4	27.9	43.6	22.1	1.77	
Sad	55.3	27.2	44.7	20.7	1.52	
Smile-Nonenjoyment	55.7	25.9	44.3	31.6	1.37	
Smile-Enjoyment	50.3	26.2	49.7	32.4	0.06	
Anger	45.0	28.6	55.0	29.4	−1.20	
Contempt	50.3	29.4	49.7	29.0	0.08	
Fear	52.8	24.7	47.2	19.5	0.88	
Surprise	52.4	25.7	47.6	19.8	0.73	
Glare	62.8	27.4	37.2	25.1	3.38	0.001
Teeth clench	50.2	17.5	49.8	16.3	0.09	
Tight lips	52.1	27.3	47.9	31.4	0.49	
Lateral smile	49.6	21.6	50.4	23.2	−0.13	
Brow raise	52.4	29.9	47.6	28.8	0.57	

* p values are two-tailed.

The correlations between FACS scores and the speech components were examined in order to provide further information on the constructs assessed by FACS. The correlations among the FACS scores for Glare, Disgust, Contempt, and Anger were also examined since, as mentioned in the Introduction, Disgust, Anger, and Contempt are presumed to be related to hostility or aggressive reactions. As shown in Table 4, there are significant relationships between a number of these measures. In particular, the Glare facial score correlated significantly with Hostility and Competitiveness, two of the speech components that have been previously shown to be associated with CHD incidence (21). Disgust, another facial behavior on which Type As and Bs were found to differ, was significantly associated with the following Speech components: Hostility and Competitiveness. Unlike Glare, the Anger facial component did not show a positive association with any of the speech components. Contempt was significantly related to Despondency ($r = 0.34$, $p < 0.01$). There were several significant correlations observed among the FACS scores. The correlation between Glare and Disgust was significant ($r = 0.39$, $p < 0.01$). Contempt was significantly related to both Anger and Disgust but not Glare.

The extent to which the relationship of Type A to Glare and Disgust was due to the Hostility and Competitive components of Type A behavior was examined using Glare and Disgust scores adjusted for the two speech components. No significant differences between Type As and Type Bs on these two facial behaviors were observed when these scores were adjusted.

The strength of the association between FACS scores and the cardiovascular reactivity measures was assessed by testing the Spearman rank correlation coefficient for each pairing of FACS score and the two cardiac measures. Heart rate variability was positively associated with Nonenjoyment Smiles, and heart rate respon-

TABLE 3. Speech Component Percentile Scores for Type As and Type Bs

Behavior Type	Type A		Type B		t	p*
	X	SD	X	SD		
Speech Components						
Hostility	67.7	25.0	32.3	20.7	5.35	0.001
Competitiveness	63.8	26.6	36.2	25.1	3.70	0.001
Immediateness	63.8	22.6	36.2	28.6	3.72	0.001
Speaking Rate	65.3	16.9	34.7	23.8	5.15	0.001
Type A Content	59.9	31.1	40.1	23.7	2.47	0.01
Anger-Out	61.2	28.3	38.8	25.6	2.89	0.005
Self-Aggrandizement	61.4	26.2	38.6	27.3	2.95	0.004
Exactingness	53.1	29.7	46.9	28.8	0.74	
Despondency	43.0	26.4	57.0	28.7	−1.75	
Loudness	67.5	24.3	32.5	20.2	5.44	0.001
Syllabic Emphasis	70.1	22.4	29.9	16.8	7.02	0.001
Acceleration	57.5	30.4	42.5	25.4	1.85	
Hard Voice	61.4	21.1	38.6	21.2	3.74	0.001

* p values are two-tailed.

TABLE 4. Correlations Between FAC Scores and Speech Components

FACS Components	Glare	Disgust	Anger	Contempt
Speech Components				
Hostility	0.411**	0.339**	−0.167	0.035
Competitiveness	0.367**	0.317*	−0.110	0.039
Immediateness	0.100	0.156	−0.258	−0.206
Speaking Rate	0.1512	0.180	−0.342	−0.092
Type A Content	0.144	0.062	0.024	−0.204
Anger-Out	0.292*	0.235	0.054	0.047
Self-Aggrandizement	−0.002	0.064	−0.077	−0.151
Exactingness	0.143	0.167	−0.061	0.040
Despondency	0.229	0.167	0.120	0.335**
Loudness	0.423**	0.248	−0.082	0.023
Syllabic Emphasis	0.339**	0.241	−0.120	−0.107
Acceleration	0.303*	0.253	0.233	0.108
Hard Voice	0.135	0.143	0.063	−0.234
FACS Components				
Contempt	0.180	0.308*	0.303*	
Anger	−0.117	0.130		
Disgust	0.390**			

* $p < .05$, ** $p < .01$; p values are two-tailed.

sivity was negatively associated with this same facial behavior. This indicates that those subjects showing more Nonenjoyment Smiles had more heart rate variability ($p < 0.02$) but less magnitude of overall change in heart rate ($p < 0.04$) during the SI. None of the other relationships between FACS scores and the cardiac reactivity measures was significant. Subjects were also divided into high and low groups based on their FACS scores on Glare and Disgust. Similar analyses of variance for heart rate measures showed no significant differences among the Type A/B-FACS score subgroups.

The relationship between the speech component scores and the cardiovascular reactivity measures as well as the extent of differences between Type As and Bs in cardiovascular reactivity were also examined. None of the relationships between the speech component scores and cardiac reactivity measures was significant. Also, there were no significant differences between the two behavior types for either heart rate responsivity or heart rate variability.

DISCUSSION

Facial behavior–Disgust and Glare–differentiated Type As from Bs. None of the other facial behaviors studied, including those noted in the clinical literature describing Type A behavior (see Table 1), showed significant differences between Type As and Bs. With regard to the facial behaviors originally described as characteristic of Type As, it is possible that the early Type A researchers noted differences between Type As and Bs in facial behaviors but, without the benefit of the precise FACS scoring, were unable to adequately define or assess these facial expressions. Since Type As have been described as hostile and aggressive, it might seem surprising that the Type As did not show more anger or contempt facial expressions than did the Bs. Understanding this finding and reconciling it with the positive finding on the Glare score and Disgust requires drawing some theoretical distinctions among affective phenomena.

Emotional traits, such as hostility, can be distinguished from moods, such as irritability, as well as from the emotions such as anger (42). An emotion involves, from this perspective, a momentary and patterned set of changes in physiology, cognitive activity, subjective feelings, and facial expression. Moods involve much more extended periods of time, hours, or even days, as compared with the second or minutes for emotions. Each mood is saturated with frequent occurrences of a particular emotion(s). When someone is in an irritable mood, he/she is ready to become angry, likely to construe matters in such a way so as to have the opportunity to become angry, and his/her anger when it occurs is likely to be more intense and of greater duration than it would be when he/she is are not in an irritable mood. A trait refers to an even longer span of time than a mood. A trait is considered to be a characteristic style of behavior which predominates at least during a life epoch or phase, and perhaps across more than one epoch in the life span. A hostile trait may be manifested by frequent bouts of irritability, by an aggressive behavioral style, or in impatience, abruptness, and related behaviors.

The Anger facial expression assessed in the present study reflects the emotion of anger. It was rarely displayed by the subjects during the interviews examined in this study, and did not differ in occurrence for Type As or Bs. The salaried, predominantly management, people who were our subjects may have learned, we presume, to monitor and suppress anger expression. This might be especially so for Type A individuals holding such jobs who may have learned the negative consequences of not inhibiting expressions of their anger.

The brows/lowered eyelids tense activity, a category of facial behavior that we developed on the basis of observations in the clinical literature about the appearance of Type A individuals, is open to three interpretations: (1) Glare might be the result of attempts to inhibit the full expression of the anger emotion. The Type A who becomes angry may have attempted to suppress the anger, managing to block its appearance in the lips, with only a fragment of the full anger expression escaping censorship, manifest in the brows and/or eyes. (2) This registration of anger in the upper part of the face might reflect a low intensity of anger elicited by the SI which, though challenging, does not typically provoke anger. (3) The Glare facial expression may mark the trait of hostility not the emotion of anger. With this latter interpretation, Glare represents the aggressive or hostile stance one person takes toward others.

While we have no definitive data to allow a choice between these three interpretations, the lack of a significant relationship between the Glare and Anger scores is consistent with the second and third interpretation. Recent research by others (43) also provides support for these two interpretations. This research showed that only when a challenging laboratory task was administered in a manner involving harassment of the subject by the experimenter did subjects who had scored high on a personality trait measure of hostility show increases in anger. The same task administered without harassment failed to elicit such anger increases (43). Similarly, in the present study, the SI was not presented in a harassing manner and thus may have not been sufficiently challenging to provoke the emotions of anger or contempt. It is of interest that in the previously described laboratory experiment (43), those high in hostility showed enhanced cardiovascular arousal only in response to the harassment condition. This finding may also explain the failure in the present study to observe relationships between hostility and cardiovascular reactivity.

The relationship between the Glare score and the Hostility speech component provides further support for the third interpretation. The speech components are conceptualized as measuring a style of speaking associated with the enduring behavioral pattern not with a momentary emotion. Indeed these speech components, which show the highest correlation with Glare score, predicted CHD (21–23). The facial score of the emotion anger was inversely (but not significantly) correlated with these speech component measures.

Questions might be raised about why the Type A subjects showed more Disgust than the Bs, especially since they did not differ on Anger. Although Disgust is an emotion like anger, it may not be the emotion that the Type A subjects are vigilantly monitoring and suppressing. The expression of Disgust might reflect, at least in part, the shifting of angry feelings to this less censored but related emotion. As was the case with Glare, a different but not contradictory explanation for the difference between Type As and Bs in

Disgust is that the expression of this emotion reflects an underlying trait of hostility. In conjunction with this interpretation, it is relevant that recent research has shown a relationship of emotions related to Disgust–cynicism and hostility–to the severity of atherosclerosis (8, 10, 16).

The findings on facial behavior raise the question as to whether these measures would add to more conventionally used approaches to identifying individuals at increased risk for CHD. The results of the analysis using the adjusted facial behavior scores indicated that the higher Glare and Disgust scores in the Type As compared with the Type Bs are accounted for by the strong relationship of hostility to Glare and Disgust. These results suggest that the Glare and Disgust facial behaviors are an expression of the increased hostility of Type A individuals. Given that the Hostility speech component was found in prospective research to be the strongest predictor of CHD (21–23), and that Glare and Disgust correlated significantly with this component in the present study, there is the possibility that these facial expressions may add new dimensions to the assessment of coronary-prone behavior.

The question for further research is to explore how these measures of facial and speech behavioral components interrelate in predicting CHD. To what extent does adding facial behavior scores such as Glare assist in identifying individuals who are coronary-prone? Might it be that those who manifest both hostile facial and speech components are at the greatest risk? Among those whose facial and speech components are not consonant, is one or another set of components more successful in predicting CHD, or are these people not at risk?

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