Summary of Our Unique Approach

We are mounting a crusade to improve editorial and review procedures. Existing procedures of current journals have been shown to have an unethical lack of reliability and validity. We are using an unusual set of procedures to promise editorial decisions in five weeks and publication in an average of four months with courteous and tested procedures. In return, accepted papers share some of the costs of publication—but this is independent of editorial decisions!

"Reluctantly, one must conclude that the contents of prestigious behavioral science journals are largely chance determined...which raises questions as to what fails, in such a system, ever to see the light of day."
Belver C. Griffith,
School of Library Science, Drexel University

I think that what has been demonstrated by this study [of psychology journals] is...reviewer and editorial incompetence..."
Rosalyn S. Yalow
Nobel Laureate in physiology/medicine

JOURNAL OF SOCIAL BEHAVIOR AND PERSONALITY

ISSN: 0886-1641
CODEN: JSBPE9

JOURNAL of SOCIAL BEHAVIOR and PERSONALITY

An Interdisciplinary Journal

Vol. 10, No. 2 1995

Journal of Social Behavior and Personality

June 1995 · Vol. 10, No. 2

The Impact of Vocal Feedback on Emotional Experience and Expression

Elaine Hatfield
Department of Psychology, University of Hawaii
2430 Campus Road, Honolulu, HI 96822

Christopher K. Hsee
Graduate School of Business, University of Chicago
Chicago, IL 60637

Jason Costello
Monique Schalekamp Weisman
Colin Denney
Department of Psychology, University of Hawaii
2430 Campus Road, Honolulu, HI 96822

Darwin argued that emotional experience should be affected, in part, by feedback from the skeletal musculature. Since Darwin's time, researchers have documented that emotional experience is shaped by both facial and postural feedback. Two experiments were conducted to determine whether emotional experience and facial expression are influenced by vocal feedback as well. In Experiment 1, subjects were asked to read a joyous, loving, sad, or angry script. The impact on emotional experience and expression was assessed in two ways: (a) Subjects completed a self-report measure of emotion, and (b) judges rated subjects' faces as they read the scripts. In Experiment 2, subjects were required to try to reproduce a "random" sound pattern vocally. These tones were designed to mimic the voice quality, rhythm, intonation, and pausing associated with joy, love, sadness, anger, or fear, or, in the control condition, with an emotionally neutral state. The impact on subjects' subjective emotional experience was assessed by a self-report questionnaire. As predicted, in both experiments, emotional experience and/or facial expression were affected by verbal and/or vocal feedback (Experiment 1) and by vocal feedback alone (Experiment 2). Possible explanations for these results are discussed.

Authors' Note: Address correspondence to the first author.

Journal of Social Behavior and Personality, 1995, Vol. 10, No. 2, 293–312

Fischer, Shaver, and Carnochan (1990) defined emotions as:

> ...organized, meaningful, generally adaptive action systems...[they] are complex functional wholes including appraisals or appreciations, patterned physiological processes, action tendencies, subjective feelings, expressions, and instrumental behaviors....None of these features is necessary for a particular instance of emotion. Emotions fit into families, within which all members share a family resemblance but no universal set of features (pp. 84–85).

There is, of course, still disagreement as to what, precisely, constitutes an emotion family (Ekman, 1992; Izard, 1992; Ortony & Turner, 1990; Panksepp, 1992). Most theorists, however, would agree that emotional "packages" are comprised of many components. These include: conscious awareness; facial, vocal, and postural expression; neurophysiological and autonomic nervous system activity; and instrumental behaviors. Different portions of the brain process the various aspects of emotion (Gazzaniga, 1985; Lewicki, 1986; MacLean, 1975; Panksepp, 1986; Papez, 1937). Today, theorists are becoming interested in how each of the emotional components acts on and is acted upon by the others (Berscheid, 1983; Candland, 1977; Carlson & Hatfield, 1992).

Emotional Experience and Facial, Postural, and Vocal Feedback

Emotional experience is reflected in a person's face, voice, and posture. The reverse is probably true as well; emotional experience may be shaped by changes in the skeletal musculature and the accompanying proprioceptive feedback. Darwin (1965) argued:

> The free expression by outward signs of an emotion intensifies it. On the other hand, the repression, as far as is possible, of all outward signs softens our emotions. He who gives way to violent gestures will increase his rage; he who does not control the signs of fear will experience fear in a greater degree (p. 365).

Modern-day researchers have documented the tight links between emotional experience and changes in the skeletal musculature (Ekman, Levenson, & Friesen, 1983; Hatfield, Cacioppo, & Rapson, 1993).

The facial feedback hypothesis. Darwin (1965) argued that emotional experience should be profoundly affected by proprioceptive feedback from the facial muscles. James (1984) proposed that people infer their emotions by sensing their muscular, glandular, and visceral responses. Today, most theorists agree that emotions are influenced to some extent by proprioceptive feedback from the facial musculature (see Adelman & Zajonc, 1989; Lanzetta & McHugo, 1986; Manstead, 1988, for reviews of this research). What they disagree about is how important such feedback is (Is it necessary, sufficient, or merely a small part of the emotional experience?) and exactly how the two are linked (see Hatfield et al., 1993; Hatfield, Cacioppo, & Rapson, 1992; Izard, 1990; Tomkins, 1982).

Three types of experiments have been conducted to explore possible links between emotional experience and facial expression. In one type, subjects are simply asked to exaggerate or inhibit their naturally occurring emotional facial expressions; researchers then try to find out what effect this has on the subjects' emotional responses. Generally, subjects report that subjective emotional experiences are more intense when they exaggerate their facial expressions than when they mute them (see Kleck et al., 1976; Kopel & Arkowitz, 1974; Kraut, 1982; Lanzetta, Biernat, & Kleck, 1982; Lanzetta, Cartwright-Smith, & Kleck, 1976; Zuckerman, Klorman, Larrance, & Speigel, 1981). Of course, a few studies have failed to secure such results (e.g., Colby, Lanzetta, & Kleck, 1977; Lanzetta et al., 1976; McCaul, Holmes, & Solomon, 1982).

In a second type of experiment, experimenters try to hide the fact that they are studying emotions or manipulating emotional expression. They surreptitiously arrange the faces of the subjects into emotional expressions. Using such procedures, a variety of researchers have found that subjects' emotional feelings and/or behaviors are tempered by facial feedback (see Duclos et al., 1989; Duncan & Laird, 1977; Ekman, Levenson, & Friesen, 1983; Kellerman, Lewis, & Laird, 1989; Kleinke & Walton, 1982; Laird, 1974, 1984; Laird & Bresler, 1992; Laird & Crosby, 1974; Laird, Wagener, Halal, & Szegda, 1982; Larsen, Kasimatis, & Frey, 1990; MacArthur, Solomon, & Jaffee, 1980; Rhodenwalt & Comer, 1979; Rutledge & Hupka, 1985; Strack, Martin, & Stepper, 1988). Only a few researchers have failed to secure such results (e.g., Matsumoto, 1987; Tourangeau & Ellsworth, 1979).

Finally, in a third type of experiment, researchers have manipulated facial expressions by allowing subjects to mimic the faces of targets. Researchers find that happy faces (Bush, Barr, McHugo, & Lanzetta, 1989; Hsee, Hatfield, Carlson, & Chemtob, 1991, 1993; Hsee, Hatfield, & Chemtob, 1992; Uchino, Hatfield, Carlson, & Chemtob, 1991), sad faces (Hsee et al., 1991, 1993; Uchino et al., 1991), loving faces (Kellerman et al., 1989), angry faces (Lanzetta & Orr, 1986), and fearful faces (Lanzetta & Orr, 1981) can provoke the same emotions and facial displays in viewers.

In a variety of studies, then, we find that people tend to experience emotions consistent with the facial expressions they adopt and have difficulty feeling emotions inconsistent with those poses. Further, the links between emotion and facial expression appear to be quite specific. When people produced facial expressions of fear, anger, sadness, or disgust, they were more likely to feel not just any unpleasant emotion, but the emotion associated with those *specific* expressions. Of course, emotions are not solely or perhaps even primarily shaped by facial feedback. Nevertheless, they do seem to be influenced to some extent by such feedback.

The postural feedback hypothesis. Bull (1968) reported that, when hypnotized subjects were told to experience certain emotions, they consistently adopted appropriate postures. Conversely, when they were told to adopt certain postures, they came to experience the appropriate emotion as well; they had unusual difficulty experiencing emotions incompatible with those posed postures. There is evidence in support of this contention. Duclos and his colleagues (Duclos et al., 1989), for example, manipulated subjects into sad, angry, and fearful postures and found that their feelings came to precisely match their postures. When subjects were placed in sad postures, for example, they felt sad, but not angry or fearful (see Riskind & Gotay, 1982; Cacioppo, Priester, & Berntson, 1993, for additional evidence in support of this contention).

The vocal feedback hypothesis. Emotions are associated with specific vocal patterns of intonation, voice quality, rhythm, and pausing. Although one might argue that vocal feedback *should* influence emotional experience, scientists have conducted almost no research to document this fact. We could find only one study which seems relevant to this contention. In a series of studies, Zajonc, Murphy, and Inglehart (1989) asked subjects to make sounds like the long "e" sound in "cheese" (which required them to make a smile-like expression) and the "ü" sound in German (which required subjects to make a disgust-like expression). Here, too, the subjects' experiences came to match their vocal expressions. People tended to feel the emotions their voices and faces were induced to express.

The following two experiments were designed to test the hypothesis that subjects' subjective emotional experience and facial expressions of emotion would be influenced by verbal and/or vocal feedback. Specifically, we proposed:

> Hypothesis 1. People will come to experience the emotions associated with the emotional phrases they recite. Both valence (positive and negative) and specific emotional state will be affected by vocal proprioceptive feedback.
>
> Hypothesis 2. People's faces will come to reflect the emotions associated with the emotional phrases they recite. Both valence and specific emotional state will be affected by vocal proprioceptive feedback.

A note of caution: Probably because the process is an intricate one, and perhaps, in part, because the hypothesis is so counter-intuitive, it has been notoriously difficult to demonstrate to critics' satisfaction that emotional experience is affected by feedback from the skeletal musculature. Our goal here is necessarily a modest one. We hope merely to determine whether there is enough evidence that emotional experience is influenced not just by facial and postural feedback but by vocal feedback as well to warrant further research. Positive results should spark subsequent, more painstaking research, designed to disentangle the complex threads of the process.

In Experiment 1, we adopt the first strategy previous feedback researchers employed to test the feedback hypothesis: We ask subjects to record a brief emotional message. As critics (of various techniques for producing facial feedback) have noted, this technique for generating feedback has a critical advantage: It ensures that subjects' emotional productions will be realistic. It has, however, two serious disadvantages: (a) Subjects' self-reports may be shaped by both verbal content and/or vocal feedback, and (b) their reports may be responsive to experimenter demands. In Experiment 2, we adopt the second strategy feedback researchers have employed to test the feedback hypothesis: We disguise the fact that we are interested in emotion and ask subjects to reproduce a series of abstract sound patterns. Again, as critics have noted, this technique has a critical advantage: It ensures that subjects' subjective emotional experiences are not contaminated by verbal content; they can be influenced only by vocal feedback. This technique has one serious disadvantage, however. Subjects' vocal productions may not be typical of the specific patterns of intonation, voice quality, rhythm, and pausing associated with the various emotions. We thought that if we secured the same results with these two alternative strategies, each with different strengths and weaknesses, we would have more confidence in the validity of our results.

EXPERIMENT 1

Method

Subjects

Subjects were 60 undergraduates (21 men and 39 women) from the University of Hawaii. Their average age was 19. The sample was representative of Hawaii's multi-ethnic population: Subjects were of Japanese, Chinese, Korean, Filipino, Hawaiian, Pacific Island, Hispanic, Caucasian, Black, and mixed ancestry.

Procedure

The experimenter began by explaining the "purpose" of the experiment. He claimed to be an applied social psychologist, consulting with the telephone company, which was interested in finding out how well people can communicate over various kinds of telephone equipment. Subjects would be asked to read, as realistically as possible, short transcripts depicting a happy, loving, sad, or angry interaction. Voice analysis would

enable psychologists to find out how clearly a wide array of voice tones could be transmitted over various kinds of equipment.

Subjects were escorted to an experiment room and seated in a comfortable easy chair. We wished to film subjects' faces surreptitiously as they made their telephone calls. Thus, we arranged things so that they were relatively immobile. A lapboard, intended to provide "working space," was positioned across the arms of the chair; the prop telephone was placed on the board on the subject's left, and an intercom was positioned on the right. Subjects were given a pair of headphones and asked to attach a clip mike to the front of their clothes.

The experimenter then gave subjects a folder divided into four sections. Each section contained a transcript and an emotion self-report scale, along with some other seemingly relevant questionnaires. Subjects were given a page of printed directions: They were asked to make four simulated phone calls "to their best friends." After each call was made, they should answer a brief questionnaire. Subjects believed that they were making the calls and answering the questionnaires in complete privacy; actually their faces were being secretly videotaped throughout the experiment.

Subjects repeated this procedure four times. Between trials, they listened to selections of relaxing music for three to five minutes through their headphones. At the end of the experiment, the subjects were debriefed. The experimenter told them the session had been videotaped and asked for their permission to view the tape. (Four subjects refused to give us permission to view the surreptitiously recorded videotapes.)

The Scripts

At the start of Trial 1, subjects were randomly assigned to read one of four emotion scripts. The scripts began with the following instructions.

> Here's your script. Please read it over to yourself a couple of times so that you feel comfortable with it. When you feel ready to speak the piece into the telephone let me know. Remember, we don't care what you *look like* during the call. (This isn't video-phone after all.) We are interested solely in what you *sound like*. Try to sound as _____ as possible as you speak the part.
>
> *Joy and Happiness*
>
> Today is the happiest day of my life. It's my 20th birthday. Some buddies of mine decided to throw a surprise birthday party for me. They rounded up a bunch of my friends, snuck into my apartment, decorated it, and waited for me to come in from work. When I walked in the door there they were! I couldn't believe it. There was screaming and shouting and I could hardly stop laughing. I can't imagine I'll ever have a day like that again.
>
> *Love*
>
> Well, let me tell you. Now that I'm in love, I think about John (Susan) constantly. I can twist any conversation around in my mind so that it's really about him (her). I imagine what he (she) would say to me and how I might tell him (her) things I have never told anyone else before. When I see him (her), POW! my heart takes a leap, my cheeks flush, and I can't help smiling. At night before I go to bed, I think of how adorable he (she) is and how much I love him (her).
>
> *Sadness*
>
> I feel terrible, like the wind has just been knocked out of me. Today was a nightmare....I just heard my little brother has leukemia and has to have chemotherapy. I am in shock. I didn't realize I cared so much for him....I just always thought of him as sort of a pest. I never thought he might die. I spent all day crying. When we went to the hospital, I tried to hide my feelings so that he wouldn't see how terrible I felt, but it is awful. I just feel terrible.
>
> *Anger*
>
> I hate you. Do you understand? You have ruined all that we had together. I hope she's (he's) worth all this to you. What about us? What about the kids? Where do I go from here? All those times I asked you if anything was wrong. You just said, "Oh no, hold on a little longer. I'm just working late to earn a little money." And all the time you were out with him (her). Don't tell me not to yell. You are the one who decided to have the affair, not me. You've ruined everything.

Which scripts subjects read on Trials 2–4 was also randomly determined (by selecting from the remaining scripts). Since initial statistical analyses made it clear that Order effects were non-significant, as hoped, we collapsed over Order in subsequent analyses.

Dependent Measures

Subjects' self reports. After the subjects had telephoned a joyous, loving, sad, or angry message to a "friend" they turned to the questionnaire, which said:

> One last favor. It would help us in analyzing the data, if we had a check on what sort of mood you are in right now, at this

moment. (That might affect how you delivered the message, somehow.) How strong is your joy and happiness, passionate love, sadness, or anger right at this moment?

Subjects were asked to rate their feelings of joy/happiness, love, sadness, and anger on a scale developed by Borg (1982), which allows the ratio measurement of categorical data related to subjective experience of intensity. These four ratings were each made on an 11-point scale ranging from 0 (Nothing at all) to 10 (Extremely strong: Maximum) (see Borg, 1982; Doherty, Orimoto, Singelis, Hatfield, & Hebb, in press; Hsee et al., 1991; Hsee et al., 1992, for information on the reliability and validity of the Borg scale). Subjective emotional experience was assessed in two ways: Firstly, to measure the *valence* (positive or negative) of emotion, a happiness index was calculated by summing subjects' scores on the two positive emotion items (joy + love) minus their scores on the two negative items (sadness + anger). (A note: Correlations between the two positive ratings (joy and love scores) in the joy, love, sadness, and anger conditions were .56 ($p < .001$), .81 ($p < .001$), .32 ($p < .025$), and .66 ($p < .001$), respectively, and correlations between the two negative ratings (sadness and anger scores) in the same four conditions were .82 ($p < .001$), .88 ($p < .001$), .53 ($p < .001$), and .46 ($p < .001$), respectively.) Possible scores on the happiness index ranged from +20 (Extremely positive), through 0 (Emotionally neutral), to -20 (Extremely negative). Secondly, to assess to what extent subjects were feeling each of the specific emotions, their scores on the joy, love, sadness, and anger items were individually recorded. This time, possible scores ranged from +10 (Extremely strong: Maximum) to 0 (Nothing at all).

Judges' ratings of subjects' facial expressions. If subjects refused to allow us to view their videotapes (as did four subjects), if they were too short or too tall (and thus their faces eluded our hidden cameras), or if they moved during the surreptitious filming, their images were lost to us. Tapes were available from 36 of the 60 subjects (12 were men and 24 were women). The facial reactions of these 36 subjects were edited into a single tape, containing 36 faces x 4 time periods = 144 30-second segments. The segments began when subjects initiated their telephone calls and ended when they hung up. Four judges, who were blind to the hypotheses and to the subjects' experimental conditions, independently viewed each segment and rated how joyous, loving, sad, and angry the subjects' faces seemed to be, on the same scales we described earlier. (The edited tape did not contain an audio track, so there were no verbal or tonal clues as to the subjects' experimental condition.) To measure the *valence* of subjects' facial expressions of emotion, a happiness index was constructed by summing judges' ratings of subjects' faces on the two positive items (joy + love) minus their ratings on the negative items (sadness + anger). (A note: Correlations between the two positive ratings (joy and love scores) in the joy, love, sadness, and anger conditions were .57 ($p < .001$), .59 ($p < .001$), .37 ($p < .05$), and .48 ($p < .005$), respectively, and correlations between the two negative ratings (sadness and anger scores) in the same four conditions were .55 ($p < .001$), .31 ($p < .07$), .00 ($p > 1$), and -.23 ($p > 1$), respectively.) As before, possible scores on the happiness index ranged from +20 (Extremely positive) to -20 (Extremely negative). Secondly, to assess to what extent subjects' faces were expressing each of the four basic emotions, judges' average ratings on the joy, love, sadness, and anger items were individually recorded. Once again, possible ratings ranged from +10 (Extremely strong: Maximum) to 0 (Nothing at all.).

Finally, we assessed inter-rater reliability by intercorrelating the four judges' ratings of subjects' facial expressions on the happiness index. The average inter-rater correlation was .50; correlations between the judges ranged from a low of .43 to a high of .65. The Spearman-Brown reliability coefficient was .80.

Results

If the vocal feedback hypothesis is correct, both subjects' subjective emotional experience and their facial expressions should be influenced by verbal/vocal feedback.

Hypothesis 1

Happiness index ratings. Researchers have been locked in a bitter debate as to whether subjective emotional experience is affected only by the *valence* or by the *specific* emotional type of the feedback (Duclos et al., 1989; Laird, Cuniff, Sheehan, Shulman, & Strum, 1989; Matsumoto, 1987; Tourangeau & Ellsworth, 1979). Thus, we first tested the hypothesis that subjects' subjective emotional *valence* would be affected by verbal/vocal feedback. Subjects' self-ratings of emotion are shown in Table 1. As predicted, subjects who read scripts depicting joy and love secured positive scores on the happiness index. Subjects who read scripts depicting sadness and anger secured negative scores. Subjects in the two positive conditions and the two negative conditions did secure significantly different index scores: $F(1, 57) = 131.74$, $p < .001$.

Ratings of specific emotions. Next, we tested the hypothesis that subjects' *specific emotional reactions* would be affected by vocal feedback. Subjects' self-reports of emotion in the various conditions are shown in Table 1. We found that, with one exception, subjects in each of the conditions were affected by their own specific vocal feedback. Sub-

TABLE 1 Subjects' Ratings of Emotion

Experimental Condition	*Emotion Measure*				*Happiness Index*
	Joy	*Love*	*Sadness*	*Anger*	
Joy	*5.14*	1.79	.30	.16	+6.47
Love	5.08	*4.45*	.28	.06	+9.19
Sadness	.56	1.64	*5.43*	1.97	-5.20
Anger	.69	.77	2.30	*5.32*	-6.16

jects in the *joy* condition reported feeling more joy than did subjects in any other condition: Fs(1, 57) ranged from a low of .07 (for the comparison of joy versus love) to 114.06 (for joy versus anger) and 121.56 (for joy versus sadness). The latter two were significant at $p < .001$. The subjects in the joy and love conditions did *not* differ significantly in how much joy they felt, however, $F(1, 57) = .07$, ns. (Evidently, joy and love overlap to some extent.) Joy condition subjects *were* significantly more joyous than subjects in either the sadness condition, $F(1, 57) = 121.56$, or the anger condition, $F = 114.06$. Both Fs were significant at $p < .0001$. Subjects in the *love* condition felt more love for their partners than did subjects in any other condition: Fs(1, 58) ranged from 38.33 to 71.64. All were significant at $p < .0001$. Subjects in the *sadness* condition felt sadder than did subjects in any other condition: Fs(1, 58) ranged from 48.67 to 118.19. All were significant at $p < .0001$. Finally, subjects in the *anger* condition were more angry than were subjects in any other condition: Fs(1, 58) ranged from 66.11 to 149.33. All were significant at $p < .0001$.

Hypothesis 2

Next, we turned to a more objective indicant of emotion—facial expression. We tested the hypothesis that subjects' facial expressions of emotion would also be affected by verbal/vocal feedback.

Happiness index ratings. First, we tested the hypothesis that emotional *valence* would be affected by verbal/vocal feedback. As predicted, subjects who read scripts depicting joy and love secured positive scores on the happiness index (see Table 2). Subjects who read scripts depicting sadness and anger secured negative scores on the happiness index. Subjects in the two positive and the two negative conditions did secure significantly different scores on the index, $F(1, 35) = 75.70$, $p < .001$.

TABLE 2 Judges' Ratings of Emotion

Experimental Condition	*Emotion Measure*				*Happiness Index*
	Joy	*Love*	*Sadness*	*Anger*	
Joy	*3.90*	1.48	.56	.62	+4.20
Love	2.13	*1.81*	1.27	.91	+1.76
Sadness	.64	.70	*3.34*	1.13	-3.13
Anger	.95	.72	1.75	*3.41*	-3.49

Ratings of specific emotions. Finally, we tested the hypothesis that subjects' *specific emotional reactions* would be affected by verbal/vocal feedback. Again, judges' ratings of the emotions displayed on subjects' faces are shown in Table 2. We found that subjects were affected by their specific verbal/vocal feedback. Subjects in the *joy* condition possessed more joyous faces than did subjects in any other condition: Fs(1, 35) ranged from 42.82 to 85.03. All were significant at $p < .0001$. With one exception, subjects in the *love* condition possessed more loving faces than did subjects in any other condition. Judges rated the faces of subjects in both the love and joy conditions as equally loving, $F(1, 35) = 1.99$, ns. In all other cases, however, the differences were significant: Fs(1, 35) ranged from 15.93 to 16.37. Both were significant at $p < .0001$. Subjects in the *sadness* condition looked sadder than did subjects in any other condition: Fs(1, 35) ranged from 25.79 to 78.12. All were significant at $p < .0001$. Finally, subjects in the *anger* condition looked more angry than did subjects in any other condition: F(1, 35), ranged from 35.70 to 64.61. All were significant at $p < .0001$.

This study, then, seems to provide some support for the verbal/vocal feedback hypothesis. Of course, as we warned earlier, Experiment 1 is not without its flaws. For example, critics may well ask: "Are these results due to subtle demand characteristics?" Subjects knew, after all, that the experimenter wanted them to read a joyous, loving, sad, or angry script. Perhaps they thought that to do a "good job" they ought to *feel* the part. (This might account for subjects' self-reports of emotions. It is a stretch to try to use this explanation to explain their facial expressions.) "Were subjects' subjective emotions fired by the *content* of their verbal messages rather than by the non-verbal sounds they produced?" (Velten,

1968, provides evidence that such cognitive messages can generate strong emotions.)

Finally, critics might argue that for neurological reasons, the facial and the vocal musculature operate together as a package. If that is so, they could argue, subjective emotional experiences may have been effected by the facial expressions which accompanied the verbal/vocal messages rather than by feedback from the verbal/vocal messages themselves. Perhaps this study simply demonstrated the importance of the facial feedback, albeit feedback produced by novel means (via its connection to vocal feedback).

To deal with the first two of these problems, in Experiment 2 we follow the time-worn procedure of previous researchers: We test the vocal feedback hypothesis a second time using a paradigm that disguised the fact that we were interested in emotion, eliminating the emotional message, and substituting an abstract emotional sound pattern in its place.

EXPERIMENT 2

Method

Subjects

Subjects were 160 students (68 men and 92 women) from the University of Hawaii. Their average age was 19. They were of Japanese, Chinese, Korean, Filipino, Hawaiian, Pacific Island, Hispanic, Caucasian, Black, and mixed ancestry.

Procedure

Subjects were told that the purpose of the study was to record a range of voices and sound patterns to be used in testing telephone equipment.

Subjects were then led to a private room. They were given a cassette tape which contained one of six sound patterns (joy, love/tenderness, sadness, fear, anger, or a neutral control tape). They were asked to listen to the sound pattern and practice reproducing its elements. Once they felt comfortable, they were to try to reproduce it as exactly as possible into a telephone recorder. At the end of the experiment, subjects were asked for "one last favor." The experimenter claimed it would help her in analyzing the data if she had a check on what sort of mood they were in, right at the moment (because their mood "might have affected their ability to reproduce various sounds"). Subjects then filled out a self-report emotion measure.

Developing the Tapes

Communication researchers (Bloch, Orthous, & Santibanez-H, 1987; Clynes, 1980; Morris, 1971; Scherer, 1982) have observed that the various emotions are linked with specific patterns of intonation, voice quality, rhythm, pausing, and breath control. For example, Scherer (1982) found that when people were happy they produced sounds with small amplitude variation, large pitch variation, fast tempo, a sharp sound envelope, and few harmonics. The first step in developing stimulus tapes was to ask 20 psychiatrists, psychologists, and graduate students who were experts in communications to help identify the sound patterns that had been found to be associated with joy, love, sadness, fear, anger, and lack of emotion. Then they were asked to try to generate and record 10- to 12-second sound segments which contained the sound characteristics that were typical of the emotions. Words were not included as part of the sound stimulus; only sounds were allowed. Then the group met and tried to identify those 10- to 12-second segments that seemed to best meet the criteria. The joy sounds they selected had the subjective sound of merry laughter; the companionate love tape consisted of a series of soft "ooohs" and "aaahs"; the sadness tape had sounds of crying; the anger tape consisted of a series of low growling noises from the throat; and the fear tape consisted of a set of short, sharp cries and gasps. Finally, the neutral pattern was one long monotone sound without any breaks.

When we had settled on the final tape selection, we assessed the effectiveness of our experimental stimuli in the following way:

Sixty students (23 men and 37 women) from an introductory social psychology class were asked to listen to the six tapes. Subjects were told that we planned to conduct an experiment designed to determine how effective various kinds of telephone equipment were in transmitting various kinds of sounds. We said we had randomly generated hundreds of sound patterns. However, during a pretest of the experiment, some students had commented that a few of the patterns sounded like human voices, expressing various kinds of emotion. If this were true, it might conceivably affect our results. Thus, we would like subjects to listen to the tapes and tell us which emotion, if any, the sounds suggested to them. We played the tapes for subjects, in random order, and asked, "If you had to choose an emotion that this sound represents, which emotion would it be? (circle one)" Possible answers were joy/happiness, love/tenderness, sadness, anger, fear, and neutral. Although many students scoffed at the idea that the patterns of sound were linked to any specific emotion, students were very good at guessing which emotions were linked to which sounds. The data indicate that emotions and the sound stimuli were linked as we had hoped they would be. Happiness was correctly identified by 98% of the subjects; love by 72% of subjects (12% of subjects confused love with sadness; 15% identified it as a neutral sound pattern), sadness by 100%, anger by 98%, fear by 92%, and the control sounds were judged to be neutral 100% of the time.

Dependent Measures

Immediately after reproducing one of the sound patterns, subjects were asked to indicate their subjective emotional experiences on the Borg (1982) emotions scales. The scale asked: "How strong is your joy/happiness, love/tenderness, sadness, anger, or fear, right at this moment?" Possible answers ranged from 0 (Nothing at all) to 10 (Maximum). For information on the reliability and validity of this scale, again, see Borg (1982).

Subjects' emotions were assessed in two ways: Firstly, to measure the *valence* (positive or negative) of subjects' emotions, we constructed a happiness index by summing subjects' scores on the two positive emotion items (joy + love) minus their scores on the three negative items (sadness + fear + anger). (A note: Correlation between the two positive ratings (joy and love scores) was .49 ($p < .001$), and correlations between the three negative scores were .18 ($p < .05$) between sadness and anger, .25 ($p < .005$) between sadness and fear, and .13 ($p = .098$) between anger and fear.) Possible scores on the happiness index ranged from +20 (Extremely happy) to -30 (Extremely unhappy).

Secondly, to assess to what extent subjects were feeling each of the specific prototypic emotions, subjects' scores on the joy, love, sadness, anger, and fear items were individually recorded. This time, possible scores ranged from +10 (Maximum) to 0 (Nothing at all.).

Finally, subjects were debriefed.

Results

If the vocal feedback hypothesis is correct, subjects' emotions should be influenced by feedback from their vocalizations.

First, we tested the hypothesis that the *valence* of subjects' emotions would be affected by vocal feedback. Mean happiness index scores for subjects in the positive conditions (joy + love) and the negative conditions (sadness + anger + fear) are shown in Table 3. As predicted, subjects in the positive emotion conditions reported significantly greater positive affect than those in the negative groups, $F(1, 154) = 8.61$, $p < .005$.

Then we tested the hypothesis that *specific emotional reactions* would be affected by vocal feedback. As predicted, subjects assigned to the *joy* condition reported experiencing significantly greater joy than did subjects in any other condition: $Fs(1, 154)$ ranged from 4.04 ($p < .05$) to 9.69 ($p < .01$). They did not experience significantly more joy than subjects in the neutral condition, however, $F = 3.18$, ns. Subjects assigned to the *love* condition did report feeling more love than did subjects in any other condition. Although they did not feel *significantly* more love than did subjects in either the joy or neutral conditions, $Fs(1, 154) = 1.89$ and .57, ns., respectively, they did, however, feel more love than did subjects in any of the three negative emotion conditions: Fs (1, 154) ranged from 4.87 to 5.26, $p < .05$. Subjects assigned to the *sad* condition were sadder than were subjects in any other condition: $Fs(1, 154)$ ranged from 4.34 ($p < .05$) to 10.99 ($p < .0001$). Subjects in the *anger* condition were angrier than were subjects in any other condition: $Fs(1, 154)$ ranged from 12.95 ($p < .01$) to 28.20 ($p < .001$). Finally, subjects assigned to the *fear* condition were more fearful than were subjects in any other condition; their ratings did not differ significantly from those of subjects in any other condition, however: Fs (1, 154) ranged from .19 to 1.41, ns.

TABLE 3 Subjects' Ratings of Emotion

Experimental Condition	*Emotion Measure*					*Happiness Index*
	Joy	*Love*	*Sadness*	*Anger*	*Fear*	
Joy	*3.98*	2.28	.98	.72	.80	+3.76
Love	2.60	*3.19*	1.13	.27	.65	+3.74
Neutral	2.74	2.68	.84	.18	.92	+3.48
Sadness	1.88	1.68	*2.34*	.11	1.09	+.02
Anger	2.43	1.73	.79	*2.05*	1.16	+.16
Fear	2.60	1.67	.42	.27	*1.37*	+2.21

DISCUSSION

Darwin argued that emotional experience should be affected, in part, by feedback from the skeletal musculature. Since Darwin's time, an array of researchers have attempted to determine if, and why, emotional experience seems to be shaped by both facial and postural feedback. In this paper, we attempt to extend Darwin's original hypothesis—proposing that emotional experience might be shaped by vocal feedback as well.

In both Experiments 1 and 2 we found support for this vocal feedback hypothesis. In Experiment 1, subjects were asked to read an emotional script. In Experiment 2, the fact that the experiment dealt with emotion was carefully disguised; subjects were asked to reproduce abstract patterns of sound. In both experiments there was evidence that vocal feedback affected the *valence* of subjective emotional experience and/or facial expression. In addition, feedback had *emotion-specific* effects as well.

Joy and love were affected to some extent by vocal feedback. However, the negative emotions (anger and sadness) were even more powerfully and differentially affected by such vocal feedback.

We could conceive of two possible explanations for the fact that it was more difficult to distinguish between the positive than the negative emotions. Emotions researchers have often found that it is more difficult to produce positive than negative emotions *in laboratory settings*. Some argue, for example, that since most subjects enter the experimental setting in a happy frame of mind, ceiling effects make it difficult to produce joy and happiness which exceed supposedly "neutral" levels (Hatfield et al., 1993; Sullins, 1991). Perhaps this explains why the distinctions between the positive emotions were so weak, while the differences between the negative emotions were so strong. Of course, it is possible that we would have found the same difference, had we tested the vocal feedback hypothesis in naturalistic settings where people arrived experiencing a wide array of emotions—from extremely positive to extremely negative. It is possible, of course, that joy and love are simply less powerfully influenced by vocal feedback than are fear and anger. Only subsequent research can determine if this difference is a stable one and, if so, what accounts for it.

Since these two experiments do seem to suggest that there is some sort of a link between emotion and vocal feedback, the next step is to find out *why* we secured such a link. Subsequent research is required to explore a variety of questions such as: What is most important in producing the subjective emotional experience–feedback link? Is it *hearing* the emotional sound patterns, *producing* the emotional sound patterns, or *both*? If we were to find that people's emotions are less stirred when they merely hear someone else recite emotional sounds than when they hear and produce emotional sounds themselves, we would again be forced to ask, why is that so? Is it *hearing* oneself speak (aural feedback) or *producing* sounds oneself (feedback from the vocal musculature), or both that is important? If we find that it is actually producing the sounds that is important, the questions continue: Why is that? Is it because facial and postural displays usually accompany vocal activity? (If so, then it would be facial and postural feedback that was important, not vocal feedback.) Or is subjective emotional experience affected by vocal activity, in and of itself?

This research, then, is intended only to be a first step, designed to determine if subjective emotional experiences are shaped by vocal feedback (for whatever reasons). We hope to encourage subsequent, more painstaking research, to disentangle the complex threads of the process.

REFERENCES

Adelman, P.K., & Zajonc, R. (1989). Facial efference and the experience of emotion. *Annual Review of Psychology, 40,* 249–280.

Berscheid, E. (1983). Emotion. In H.H. Kelley, E. Berscheid, A. Christensen, J.H. Harvey, T.L. Huston, G. Levinger, E. McClintock, L.A. Peplau, & D.R. Peterson (Eds.), *Close relationships* (pp. 110–168). New York: Freeman.

Bloch, S., Orthous, P., & Santibanez-H, G. (1987). Effector patterns of basic emotions: A psychophysiological method for training actors. *Journal of Social and Biological Structures, 10,* 1–19.

Borg, G. (1982). A category scale with ratio properties for intermodal and interindividual comparisons. In H.G. Geissler & P. Petzold (Eds.), *Psychophysical judgment and the process of perception* (pp. 25–34). Amsterdam: North-Holland.

Bull, N. (1968). The attitude theory of emotion. *Nervous and Mental Disease Monographs, 81.* New York: Coolidge Foundation.

Bush, L.K., Barr, C.L., McHugo, G.J., & Lanzetta, J.T. (1989). The effects of facial control and facial mimicry on subjective reactions to light comedy routines. *Motivation and Emotion, 13,* 31–52.

Cacioppo, J.T., Priester, J.R., & Berntson, G.G. (1993). Rudimentary determinants of attitudes: II. Arm flexion and extension have differential effects on attitudes. *Journal of Personality and Social Psychology, 65,* 5–17.

Candland, D.K. (1977). The persistent problems of emotion. In D.K. Candland, J.P. Fell, E. Keen, A.I. Leshner, R. Plutchik, & R.M. Tarpy (Eds.), *Emotion* (pp. 1–84). Monterey, CA: Brooks/Cole.

Carlson, J.G., & Hatfield, E. (1992). *Psychology of emotion.* Fort Worth, TX: Harcourt, Brace, Jovanovich.

Clynes, M. (1980). The communication of emotion: Theory of sentics. In R. Plutchik & H. Kellerman (Eds.), *Emotion: Theory, research, and experience. Vol. 1: Theories of emotion* (pp. 271–304). New York: Academic Press.

Colby, C.Z., Lanzetta, J.T., & Kleck, R.E. (1977). Effects of the expression of pain on autonomic and pain tolerance responses to subject-controlled pain. *Psychophysiology, 14,* 537–540.

Darwin, C. (1965). *The expression of the emotions in man and animals.* Chicago, IL: University of Chicago Press. (Original work published 1872)

Duclos, S.E., Laird, J.D., Schneider, E., Sexter, M., Stern, L., & Van Lighten, O. (1989). Emotion-specific effects of facial expressions and postures on emotional experience. *Journal of Personality and Social Psychology, 57,* 100–108.

Doherty, R.W., Orimoto, L., Singelis, T., Hatfield, E., & Hebb, J. (in press). Emotional contagion: Gender and occupational differences. *Psychology of Women Quarterly.*

Duncan, J.W., & Laird, J.D. (1977). Cross-modality consistencies in individual differences in self-attribution. *Journal of Personality, 45,* 191–206.

Ekman, P. (1992). Are there basic emotions? *Psychological Review, 99,* 550–553.

Ekman, P., Levenson, R.W., & Friesen, W.V. (1983). Autonomic nervous system activity distinguishes among emotions. *Science, 221,* 1208–1210.

Fischer, K.W., Shaver, P.R., & Carnochan, P. (1990). How emotions develop and how they organise development. *Cognition and Emotion, 4,* 81–127.

Gazzaniga, M.S. (1985). *The social brain. Discovering the networks of the mind.* New York: Basic Books.

Hatfield, E., Cacioppo, J.T., & Rapson, R.L. (1992). Primitive emotional contagion. In M.S. Clark (Ed.), *Review of Personality and Social Psychology* (Vol. 2, pp. 151–177). Newbury Park, CA: Sage.

Hatfield, E., Cacioppo, J.T., & Rapson, R.L. (1993). *Emotional contagion.* New York: Cambridge University Press.

Hsee, C.K., Hatfield, E., Carlson, J.G., & Chemtob, C. (1991). The effect of power on susceptibility to emotional contagion. *Contagion and Emotion, 4,* 327–340.

Hsee, C.K., Hatfield, E., Carlson, J.G., & Chemtob, C. (1993). Emotional contagion and its relationship to mood. Reported in E. Hatfield, J. Cacioppo, & R.L. Rapson, *Emotional contagion* (pp. 150–152). New York: Cambridge University Press.

Hsee, C.K., Hatfield, E., & Chemtob, C. (1992). Assessments of the emotional states of others: Conscious judgments versus emotional contagion. *Journal of Clinical and Social Psychology, 11,* 119–128.

Izard, C.E. (1990). Facial expressions and the regulation of emotions. *Journal of Personality and Social Psychology, 58,* 487–498.

Izard, C.E. (1992). Basic emotions, relations among emotions, and emotion-cognition relations. *Psychological Review, 99,* 561–565.

James, W. (1984). Emotions. In G. Allport (Ed.), *Psychology: The briefer course* (pp. 324–338). Cambridge, MA: Harvard University Press. (Original work published 1890)

Kellerman, J., Lewis, J., & Laird, J.D. (1989). Looking and loving: The effects of mutual gaze on feelings of romantic love. *Journal of Research in Personality, 23,* 145–161.

Kleck, R.E., Vaughan, R.C., Cartwright-Smith, J., Vaughan, K.B., Colby, C.Z., & Lanzetta, J.T. (1976). Effects of being observed on expressive, subjective, and physiological responses to painful stimuli. *Journal of Personality and Social Psychology, 34,* 1211–1218.

Kleinke, C.L., & Walton, J.H. (1982). Influence of reinforced smiling on affective responses in an interview. *Journal of Personality and Social Psychology, 43,* 557–565.

Kopel, S., & Arkowitz, H.S. (1974). Role playing as a source of self-observation and behavior change. *Journal of Personality and Social Psychology, 29,* 677–686.

Kraut, R.E. (1982). Social pressure, facial feedback, and emotion. *Journal of Personality and Social Psychology, 42,* 853–863.

Laird, J.D. (1974). Self-attribution of emotion: The effects of expressive behavior on the quality of emotional experience. *Journal of Personality and Social Psychology, 33,* 475–486.

Laird, J.D. (1984). The real role of facial response in the experience of emotion: A reply to Tourangeau and Ellsworth, and others. *Journal of Personality and Social Psychology, 47,* 909–917.

Laird, J.D., & Bresler, C. (1992). The process of emotional experience: A self-perception theory. In M.S. Clark (Ed.), *Review of personality and social psychology* (Vol. 13, pp. 213–234). Newbury Park, CA: Sage.

Laird, J.D., & Crosby, M. (1974). Individual differences in the self-attribution of emotion. In H. London & R. Nisbett (Eds.), *Thought and feeling* (pp. 45–59). Chicago: Aldine.

Laird, J.D., Cuniff, M., Sheehan, K., Shulman, D., & Strum, G. (1989). Emotion specific effects of facial expressions on memory for life events. In D. Kuiken (Ed.), Mood and memory: Theory, research and applications [Special issue]. *Journal of Social Behavior and Personality, 4*(2), 87–98.

Laird, J.D., Wagener, J.J., Halal, M., & Szegda, M. (1982). Remembering what you feel: The effects of emotion on memory. *Journal of Personality and Social Psychology, 42,* 646–657.

Lanzetta, J.T., Biernat, J.J., & Kleck, R.E. (1982). Self-focused attention, facial behavior, autonomic arousal and the experience of emotion. *Motivation and Emotion, 6,* 49–63.

Lanzetta, J.T., Cartwright-Smith, J., & Kleck, R.E. (1976). Effects of nonverbal dissimilation on emotional experience and autonomic arousal. *Journal of Personality and Social Psychology, 33,* 354–370.

Lanzetta, J.T., & McHugo, G.J. (1986, October). *The history and current status of the facial feedback hypothesis.* Paper presented at the twenty-sixth annual meeting of the Society for Psychophysiological Research. Montreal, Quebec, Canada.

Lanzetta, J.T., & Orr, S.P. (1981). Stimulus properties of facial expressions and their influence on the classical conditioning of fear. *Motivation and Emotion, 5,* 225–234.

Lanzetta, J.T., & Orr, S.P. (1986). Excitatory strength of expressive faces: Effects of happy and fear expressions and context on the extinction of a conditioned fear response. *Journal of Personality and Social Psychology, 50,* 190–194.

Larsen, R.J., Kasimatis, M., & Frey, K. (1990). *Facilitating the furrowed brow: An unobtrusive test of the facial feedback hypothesis applied to negative affect.* Unpublished manuscript.

Lewicki, P. (1986). *Nonconscious social information processing.* New York: Academic Press.

MacArthur, L.A., Solomon, M.R., & Jaffee, R.H. (1980). Weight and sex differences in emotional responsiveness to proprioceptive and pictorial stimuli. *Journal of Personality and Social Psychology, 39,* 308–319.

MacLean, P.D. (1975). Sensory and perceptive factors in emotional function of the triune brain. In R.G. Grenell & S. Gabay (Eds.), *Biological foundations of psychiatry* (Vol. 1, pp. 177–198). New York: Raven.

Manstead, A.S.R. (1988). The role of facial movement in emotion. In H.L. Wagner (Ed.), *Social psychophysiology and emotion: Theory and clinical applications* (pp. 105–130). New York: Wiley.

Matsumoto, D. (1987). The role of facial response in the experience of emotion: More methodological problems and a meta-analysis. *Journal of Personality and Social Psychology, 52,* 769–774.

McCaul, K.D., Holmes, D.S., & Solomon, S. (1982). Voluntary expressive changes and emotion. *Journal of Personality and Social Psychology, 42,* 145–152.

Morris, D. (1971). *Intimate behaviour.* London: Triad Grafton.

Ortony, A., & Turner, T.J. (1990). What's basic about basic emotions? *Psychological Review, 97,* 315–331.

Panksepp, J. (1986). The anatomy of emotions. In R. Plutchik & H. Kellerman (Eds.), *Emotion: Theory, research, and experience. Vol. 3: Biological foundations of emotion* (pp. 91–124). New York: Academic Press.

Panksepp, J. (1992). A critical role for "affective neuroscience" in resolving what is basic about basic emotions. *Psychological Review, 99,* 551–560.

Papez, J.W. (1937). A proposed mechanism of emotion. *Archives of Neurology and Psychiatry, 38,* 725–743.

Rhodenwalt, F., & Comer, R. (1979). Induced-compliance attitude change: Once more with feeling. *Journal of Experimental Social Psychology, 15,* 35–47.

Rutledge, L.L., & Hupka, R.B. (1985). The facial feedback hypothesis: Methodological concerns and new supporting evidence. *Motivation and Emotion, 9,* 219–240.

Riskind, J.H., & Gotay, C.C. (1982). Physical posture: Could it have regulatory or feedback effects on motivation and emotion? *Motivation and Emotion, 6,* 273–298.

Scherer, K. (1982). Methods of research on vocal communication: Paradigms and parameters. In K.R. Scherer & P. Ekman (Eds.), *Handbook of methods in nonverbal behavior research* (pp. 136–198). New York: Cambridge University Press.

Strack, F., Martin, L.L., & Stepper, S. (1988). Inhibiting and facilitating conditions of facial expressions: A non-obtrusive test of the facial feedback hypothesis. *Journal of Personality and Social Psychology, 54,* 768–776.

Sullins, E.S. (1991). Emotional contagion revisited: Effects of social comparison and expressive style on mood convergence. *Personality and Social Psychology Bulletin, 17,* 166–174.

Tomkins, S.S. (1982). Affect theory. In P. Ekman (Ed.), *Emotion in the human face* (2nd ed., pp. 353–395). Cambridge: Cambridge University Press.

Tourangeau, R., & Ellsworth, P.C. (1979). The role of facial response in the experience of emotion. *Journal of Personality and Social Psychology, 37,* 1519–1531.

Uchino, B.C., Hatfield, E., Carlson, J.G., & Chemtob, C. (1991). *The effect of cognitive expectations on susceptibility to emotional contagion.* Unpublished manuscript. Honolulu, HI: University of Hawaii.

Velten, E. (1968). A laboratory task for the induction of mood states. *Behavior Research and Therapy, 6,* 473–482.

Zajonc, R.B., Murphy, S.T., & Inglehart, M. (1989). Feeling and facial efference: Implications of the vascular theory of emotion. *Psychological Review, 96,* 395–416.

Zuckerman, M., Klorman, R., Larrance, D.T., & Speigel, N.H. (1981). Facial, autonomic, and subjective components of emotion: The facial feedback hypothesis versus the externalizer-internalizer distinction. *Journal of Personality and Social Psychology, 41,* 929–944.