

Facial expressions and their significance in pedodontics *

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Abstract

A group of 197 subjects was divided into five groups consisting of three groups of predoctoral dental students differentiated according to the level of professional education, one group of pedodontic dental assistants, and one group of pedodontists. The groups were surveyed in order to elicit their responses to a series of ten simple line-drawn faces. Each person was asked in a questionnaire to indicate on a five-point scale the degree to which an adjective was appropriate or inappropriate for each simple line-drawn face. Twenty adjectives were repeated for the ten different faces. Means and standard deviations were calculated for all responses. Results indicate that each face yielded a unique set of appropriate adjectives as perceived by all subjects. Beyond this basic agreement, however, group differences were found in the selection of other appropriate adjectives. Based upon a random subset of responses, discriminant analysis correctly assigned group membership for 96% of the subjects. It was also found that eight of the ten faces discriminated among the groups with correct reclassification ranging from 88% to 96%.

Introduction

Dental clinicians are often confronted with a child patient exhibiting uneasiness towards his dental appointment. Pre-overt and overt behavioral management problems are usually controlled using psychological or pharmacological techniques. Psychological methods are preferred in behavioral management of the normal child. Establishing rapport through verbal

communication is considered the primary prerequisite for cooperation and successful dental treatment.

Accurate interpretation of nonverbal cues such as facial expressions and body movements may be another useful vehicle to further understand the child's behavior. By accurately interpreting and understanding a child's nonverbal behavior, a pedodontist, or any other person who works with children may be more effective in intercepting adverse behavior of a child.

Darwin¹ was the first to attempt to provide evidence that the facial expressions of the emotions are innate and universal. In modern day cross-cultural studies, Ekman² also supported Darwin's contention of universality of facial expressions.

Some investigators^{3,4} concede that once the human face becomes an effective stimulus for social-emotional responsiveness, it is often utilized as a conscious or subconscious primary mode of communication. Bird-whistell³ has estimated that in a normal two person conversation, the verbal components of the communication process carry less than 35 percent of the social meaning of the situation, while more than 65 percent of the meaning is transmitted through implicit means of communication. Mehrabian⁴ also believed that during speech the majority of the impact is mediated through facial expression.

In children, the recognition of emotions which develop earliest, such as enjoyment, distress, anger, and fear will develop more rapidly than will the recognition of other emotions such as shame, disgust, and contempt.⁵ Piaget⁶ described the child's mental development as involving progressive differentiation of the cognitive categories. Thus, complex emotional-cognitive processes cannot occur in the infant or in the very young child prior to the development of certain cog-

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nitive facilities just as the acquisition of language skills is dependent on the child's cognitive development.

Since verbal behavior is not an autonomous medium for infants and very young children, they are believed to be more expressive than older children and adults. Charlesworth and Kreutzer⁷ observed that children's expression of emotions tends to be more diffuse and much more motoric, in contrast to the differentiated and subtle expressions of more mature individuals.

Several ramifications of investigating facial expressions may be significant in the dental environment. Huber⁸ has stated the following:

... facial expressions resulting from emotional reactions remain unmasked through childhood. It is thus possible to read in a child's face the true meaning of manifold expressions with all their rich modulations.

Ekman⁹ further supported Huber's observation:

"Emotions that are denied expression in one channel find another outlet." Young children have less developed verbal skills and thus resort to other "channels" of expression primarily the face. Similarly, the older child will resort to the facial expression channel rather than transgress the social norm of verbally expressing unacceptable feelings.

Judgment studies were the most popular form of research on facial expression utilizing still photographs, movie sequences, video tapes or live models.¹⁰ The brow-eye-mouth combination seems to account for a large part of the expression within a given face. Byrnes¹¹ observed: "All changes of expression are centered in the mouth, the eyes, and eyebrows—these are the only features that move of themselves." These appear to be the high information areas within the face and not unexpectedly they draw the greatest attention.

Harrison¹² studied facial expressions utilizing simple line-drawn faces which he termed pictomorphs. He used pictomorphs to reduce the human face to its simplest form in order to manipulate the elements in that form and to observe changes in response.¹² The schematic faces consisted of a circular head shape, eyebrows, eyes and mouth. Various combinations of these facial elements generated several facial expressions. A sample of 80 college students of varying academic backgrounds were asked to rate the appropriateness of various adjectives with selected faces. These results showed that a wide variety of significant information could be obtained from simple line-drawn faces.

The purpose of this study was (i) to determine whether facial expressions from simple line-drawn faces elicit different responses from various groups of dental personnel, and (ii) if so, to examine whether the groups differ enough from one another such that

Table 1. Groups (n=197)

Letter	n	
A	93	Freshman and Sophomore Dental Student
B	22	Pre-pedodontic Clinic Junior Dental Student
C	33	Post-pedodontic Clinic Junior and Senior Dental Student
D	15	Pedodontic Dental Assistant
E	34	First and Second Year Pedodontic Graduate Students and Pedodontists
Total	197	

they may be reclassified into their appropriate groups using discriminant analyses.

Methods and Materials

A group of 197 subjects was divided into five groups consisting of three groups of predoctoral dental students differentiated according to the level of professional education, one group of pedodontic dental assistants, and one group of pedodontists (Table 1). The groups were surveyed in order to elicit their responses to a series of ten simple line-drawn faces (Figure 1). Each person was asked in a questionnaire to indicate on a five-point scale the degree to which an adjective was appropriate or inappropriate for each simple line-drawn face. Twenty adjectives were repeated for the ten different faces (Figure 2). There was no time limit to complete the questionnaire, although each subject was advised to work as fast as possible. In essence, they were being asked to look at the emotion of the face and to make a quantifiable response.

For the purpose of analysis, the fifth category on the rating scale, "doesn't apply" was relegated to the middle and assigned a value of three. The first category, "strongly is" was assigned a value of one, "is" a value of two, "is not" a value of four, and "strongly is not" a value of five.

The mean score and standard deviation were calculated for each of the twenty adjectives for each face. An adjective with a mean score less than or equal to two or greater than or equal to four will be referred to as a 2,4 adjective.

Discriminant analyses were completed to see whether the five groups could be reclassified back into their appropriate groups. Of 200 possible responses per questionnaire, a random subset of twenty re-

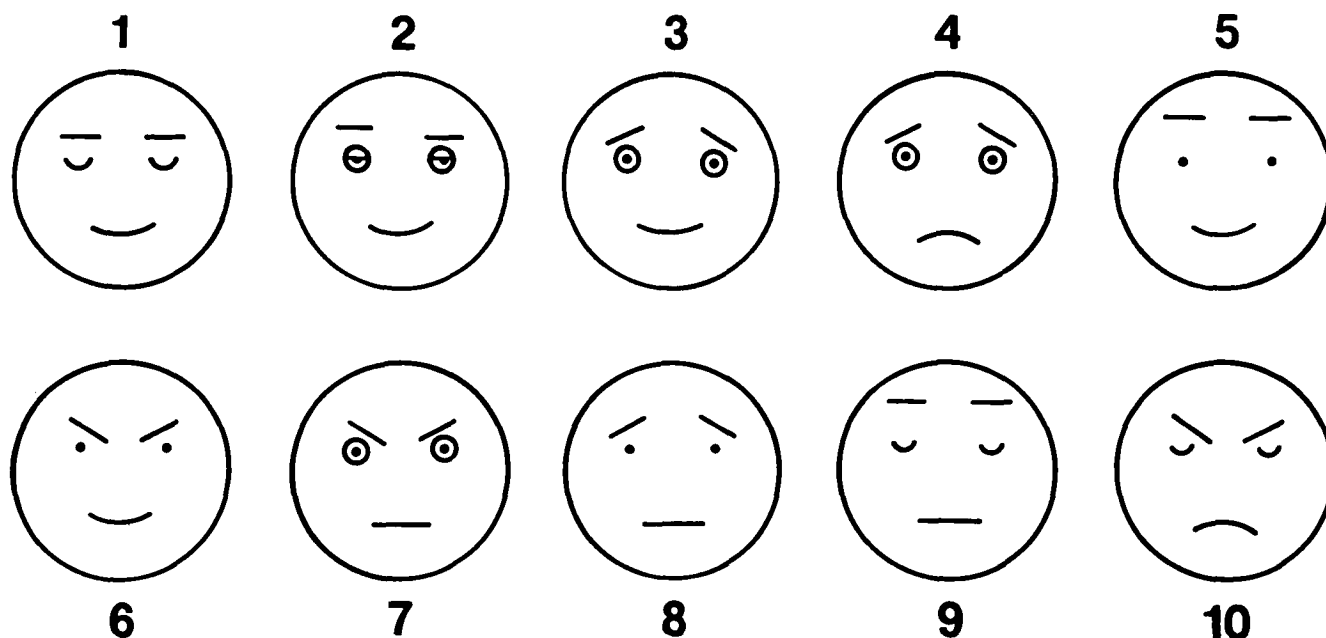


Figure 1. The simple line-drawn faces as developed by R. P. Harrison (*Beyond Words*, Prentice-Hall, 1974).

sponses was selected for analysis. In addition, discriminant analysis was completed for each of the ten faces; again, to see whether certain faces discriminated among each group.

Results

Analysis of responses indicates that each face yielded a unique set of appropriate-inappropriate adjectives as perceived by all subjects. The pattern of response is summarized in Table 2.

Table 3 lists the standard deviation of 2,4 adjectives common to groups A to E. Group D had the majority of 2,4 adjectives with the lowest standard deviation.

Means and standard deviations for all adjectives were calculated for each group A to E. Group D had the highest frequency of 2,4 adjectives as well as the lowest standard deviation among all other groups. As an example, Table 4 summarizes the responding pattern of group D. In addition, group D also had the highest number of 2,4 adjectives selected solely by that group. Group E had the next highest frequency of 2,4 adjectives.

Discriminant analysis was performed on a random subset of twenty responses. Table 5 represents the number of observations and percents classified back into the appropriate groups.

Discriminant analysis was also completed for each of the ten faces. As an example, Table 6 shows the re-

classification of group members for face 6. It was shown that eight of the ten faces did discriminate among the groups. The highest correct reclassification of judges was 95.3% (face 6) and the lowest 88.4% (face 5). The two faces that did not discriminate were faces 1 and 3.

Discussion

The results indicate that each face yielded a unique set of adjectives perceived as appropriate by all subjects. Beyond this basic agreement, however, group differences were found in the selection of other appropriate adjectives. Based upon a random subset of responses, discriminant analysis correctly assigned group membership for 96% of the subjects. It was also found that eight of the ten faces discriminated among the groups with correct reclassification ranging from 88% to 96%. The significance of these findings is that the discriminant analysis indicates that each of the groups are viewing the faces differently. It may be important because, through their experience and/or training, these groups tend to interpret these faces differently. Yet, dental personnel frequently assume that they perceive facial expressions in the same way. Before one can come to grips with these differences, they must first be identified. Such common understanding is important in effective behavior management in dentistry.

To observe these findings was an easy task. However, to account for them was difficult because their explanations could only be speculative.

The pedodontic dental assistants responded to the most number of 2,4 adjectives. Collectively, they displayed the least variability in their selections. Freshman and sophomore dental students selected fewer 2,4 adjectives with more variation. Post-pedodontic clinic junior and senior dental students and pedodontists had a higher frequency of 2,4 adjectives and a higher degree of consensus than freshman and sophomore dental students.

Each group possesses a certain level of experience which may account for their unique responding characteristics. The quantity and type of this experience may influence the responses.

Apparently, the level of achieved academic education did not influence the number of 2,4 adjectives chosen or interrater agreement within groups when responding to simple line-drawn faces. The pedodontic dental assistant may have had a high level of experience in patient management, but had considerably less academic education than the pedodontist who had both experience and education.

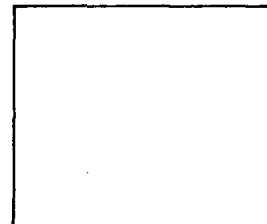
The culture of the working environment could be another important variable. The pedodontic dental assistants, pedodontists, and dental students may have responded alike due to the socialization process associated with their work responsibilities.

Because the pedodontic dental assistant group consisted entirely of females, there is a temptation to suggest a sex difference accounting for their response. There is a traditional societal concept of the emotionally expressive female who is more receptive to human psychological needs than the male. As the culture of the working environment may produce similar attitudes and thinking, so, too, may the sex-role definition be nothing more than a hierarchy of learned responses, rather than innate or purely instinctual sex differences.

Allied with the effects of experience and the cultural milieu was the possible influence of age. Experience and age are usually interdependent, as are age-related attitudes of the working environment. However, in this sample of dental personnel, the variation in age in each group was too great to fully account for the responding differences.

Perhaps, the common denominator in all groups was the degree to which the judges were "educated to see" facial expressions. Travers¹³ has stated that in judgment studies trained observers ultimately agreed whereas untrained observers showed little agreement. For example, the pedodontists had the least variation for the adjective "happy" in face 4. Perhaps, this face suggested a "pre-injection" look, and sensitized the

PLACE A CHECK (X)
IN THE APPROPRIATE
COLUMN FOR EACH
ADJECTIVE:



1. ++: strongly is
2. +: is
3. -: is not
4. --: strongly is not
5. 0: doesn't apply

	1	2	3	4	5
	++	+	-	--	0
1):.....					
2):.....					
3):.....					
4):.....					
5):.....					
6):.....					
7):.....					
8):.....					
9):.....					
10):.....					
11):.....					
12):.....					
13):.....					
14):.....					
15):.....					
16):.....					
17):.....					
18):.....					
19):.....					
20):.....					

Figure 2. The twenty adjectives were repeated for each of the ten faces located in the upper right hand corner.

clinician to this anxiety-provoking clinical procedure. Thus, the pedodontists were trained to observe this facial expression in which they played an intimate role, whereas the pedodontic dental assistants were not as sensitized to this emotion since they were not as involved with the injection procedure. Another example was the high agreement with the adjective, "angry" in face 5. Here, the face could be suggesting an "are we finished?" look which the dental assistant did recognize well.

Furthermore, the pedodontic dental assistants also selected the highest number of 2,4 adjectives that were not chosen by any other group, again suggesting that the assistants responded to what they were "educated to see." However, an important corollary to Travers's statement which must be kept in mind was that observer agreement did not necessarily imply validity.

Yet, quality behavioral science studies must be in-

Table 2. Responding pattern for groups A to E combined (n=197)

Adj	Face										Total
	1	2	3	4	5	6	7	8	9	10	
1								X			1
2				X	X	X	X			X	5
3	X				X	X	X			X	5
4						X	X			-X-	3
5						X	X			X	3
6						X	X			X	3
7	X			X	X	X	X	X		X	7
8											0
9											0
10			X	X	X			X			4
11						X	X			X	3
12											0
13				X		X		X			3
14											0
15											0
16					X						1
17											0
18							X			X	2
19	X			X	X			X			4
20							X			X	2
Total	3	0	1	5	6	8	9	5	0	9	46

X 2,4 Adj
 -X- Lowest S.D.

vestigated initially as basic research. The immediate outcome of this basic research of facial expressions is that it now provides a foundation and a methodological tool for further research.

Areas For Future Research

If the ability to accurately observe facial expressions is amenable to training, then future research possibilities seem both broad and pertinent. To further investigate the element of training, studies involving kindergarten teachers and psychologists, and studies identifying possible true sex differences, perhaps on the dimension of empathy, may be worthwhile.

The inclusion of a random sample of deaf and hard-of-hearing individuals into this study may yield significant information. If so, their interpretations could be ascribed only to training as they rely primarily on facial expressions for communication.

In the domain of dentistry, if this ability is indeed a function of training, then controlled studies are warranted to demonstrate possible enhancement of psychological behavior management techniques through a greater appreciation of facial expressions. An impor-

tant corollary is the possible identification and subsequent preparation of dental personnel to further understand the dental patient.

Conclusion

The results indicate that each simple line-drawn face yielded a unique set of adjectives perceived as "appropriate" by all subjects. Beyond this basic agreement, however, group differences were found in the selection of other "appropriate" adjectives. The pedodontic dental assistants responded to the most number of 2,4 adjectives. Collectively, they displayed the least variability in their selections.

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Table 3. Standard deviation of 2,4 adjectives common to group A to E (n=197)

2,4 Adj	Face	A	B	Group C	D	E
7	1	0.93	0.83	0.66	0.83	0.72
2	4	1.01	0.92	0.58	0.52*	0.80
7		0.80	0.91	0.69	0.63	0.50*
10		0.82	1.27	0.78*	1.06	1.22
3	5	1.00	1.04	0.80	0.46*	0.61
7		0.87	0.83	0.77	0.51*	0.78
2	6	0.90	0.70	0.78	0.51*	0.70
4		0.87	0.81	0.60	0.51*	0.65
6		0.96	0.77	0.61	0.51*	0.64
2	7	0.78	1.14	0.66	0.49*	0.56
3		1.15	0.51	0.56	0.41*	1.12
4		0.91	0.91	0.67	0.51*	0.71
7		1.05	0.92	0.97	0.41*	0.61
11		0.93	0.75	0.79	0.83	0.68*
10	8	1.04	1.06	1.00	0.35*	1.17
13		0.90	0.85	0.83	1.06	0.70*
2	10	0.89	0.83	0.62	0.49*	0.56
3		1.12	0.93	0.80*	1.06	1.12
4		0.76	0.85	0.65	0.64*	0.67
5		1.00	0.87	0.88	0.63*	0.95
6		0.88	0.70	0.61*	0.83	0.70
7		0.99	0.66	0.50*	0.64	0.53
11		0.94	0.84	0.64	0.63*	0.68
20		1.26	1.18	1.17	1.30	1.01*

* Lowest S.D. for each 2,4 Adj

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Table 4. Responding pattern for group D (n=15)

Adj	Face										Total
	1	2	3	4	5	6	7	8	9	10	
1	X										1
2	X			X	X	X	X			X	6
3	X	X	X		X	X	X	X	X	X	9
4	X			X	X	X	X			X	6
5	X			X		X	X	X	X	X	7
6	X				X	X	X		X	X	6
7	X		X	X	X	X	X	X		X	8
8											0
9					X	X	X				3
10	X		X	X	X			-X-			5
11				X		X	X	X	X	X	6
12					X						1
13				X		X	X	X			4
14											0
15					X		X		X		3
16					X	X					2
17											0
18					X		X				2
19	X		X	X	X			X			5
20					X		X			X	3
Total	9	1	4	8	13	10	12	7	5	8	77

X 2,4 Adj
X Unique Response
-X- Lowest S.D.

Table 5. Number of observations and percents classified into groups, Subset (n=187)

From Group	A	B	C	D	E	Total
A	83 96.51	0 0.00	1 1.16	1 1.16	1 1.16	86 100.00
B	0 0.00	21 100.00	0 0.00	0 0.00	0 0.00	21 100.00
C	1 3.23	0 0.00	30 96.77	0 0.00	0 0.00	31 100.00
D	0 0.00	0 0.00	0 0.00	15 100.00	0 0.00	15 100.00
E	1 3.03	0 0.00	0 0.00	1 3.03	31 93.94	33 100.00
Total	85	21	32	17	32	187
Percent	45.45	11.23	17.11	9.09	17.11	100.00

Table 6. Number of observations and percents classified into groups, Face 6 (n=192)

<i>From Group</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>Total</i>
A	84 96.55	0 0.00	1 1.15	0 0.00	2 2.30	87 100.00
B	0 0.00	21 95.45	1 4.55	0 0.00	0 0.00	22 100.00
C	2 6.06	0 0.00	31 93.94	0 0.00	0 0.00	33 100.00
D	0 0.00	0 0.00	0 0.00	15 100.00	0 0.00	15 100.00
E	2 5.88	0 0.00	1 2.94	0 0.00	31 91.18	34 100.00
Total	89	21	34	15	33	192
Percent	46.35	10.94	17.71	7.81	17.19	100.00

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