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Perception Without Awareness and Electrodermal Responding: A Strong Test of Subliminal Psychodynamic Activation Effects

Joseph M. Masling

State University of New York at Buffalo

Robert F. Bornstein

Gettysburg College

Frederick G. Poynton

State University of New York at Buffalo School of Medicine

Sheila Reed

University of Wyoming

Edward S. Katkin

State University of New York at Stony Brook

Eighty-four undergraduate male subjects were tachistoscopically exposed either to an experimental message designed to arouse anxiety (NO ONE LOVES ME), or to a neutral control message (NO ONE LIFTS IT), at 4 ms or 200 ms durations. Electrodermal responses (EDRs) were recorded before, during and after exposure to the critical messages. Three measures of awareness of 4 ms stimuli were used: recall, recognition and discrimination. No evidence of stimulus awareness was found on any of these measures. Only subjects exposed to the experimental message at 4 ms durations showed a significant increase in EDR from pre-exposure to message exposure period. These results support Silverman's (1983) hypothesis that drive-related stimuli must be presented subliminally in order to produce significant effects on behavior, and are consistent with Bornstein's (1989b) hypothesis that stimulus awareness inhibits responding to drive- and affect-related stimuli.

Requests for reprints should be sent to Joseph M. Masling, Ph.D., Department of Psychology, Park Hall, SUNY-Buffalo, Amherst, New York 14260.

The concept of unconscious influence on affect, cognition and behavior has a long and substantial history (Bornstein, 1989b; Dixon, 1971). Until relatively recently, however, few experimental paradigms were available to researchers interested in investigating systematically the nature of unconscious mental processes. During the past two decades, several procedures for examining unconscious processes have been developed (see Kihlstrom, 1987). Among the most useful (and controversial) of these procedures is the subliminal perception paradigm, in which verbal and/or pictorial stimuli are presented to subjects so quickly that the subjects are not consciously aware of the content of the stimuli. Typically, some dependent measure of responding to stimulus exposures (e.g., a projective test or behavioral measure) is then administered. The effects of conscious versus unconscious processing of stimulus content can be examined by comparing subject's responses to subliminal versus clearly-recognized (i.e., supraliminal) stimuli.

Research suggests that subjects do, in some situations, respond to stimuli perceived without awareness (Bornstein, 1989a, 1989b; Dixon, 1971; Silverman, 1983). In fact, subjects respond to stimuli perceived without awareness cognitively (Erdley and D'Agnostino, 1988), affectively (Kunst-Wilson and Zajonc, 1980) and behaviorally (Bornstein, Leone, and Galley, 1987). Furthermore, significantly stronger effects on responding are produced when subliminal drive- or affect-related stimuli are used than when the same stimuli are presented supraliminally (Bornstein, 1989a, 1989b, 1990). When drive- or affect-related stimuli are presented and drive- or affect-related dependent measures are then collected, stimulus awareness inhibits responding (Bornstein, 1989b).

The process by which stimulus awareness inhibits affective responding has not been fully investigated. However, it seems likely that certain ego defenses (e.g., denial, rationalization) and other conscious "countercontrol strategies" (e.g., attributional biases) inhibit affective responding to clearly-recognized stimuli (Bornstein, 1989a, 1990). In any case, findings from studies of perception without awareness not only further our understanding of the nature of unconscious mental processes and the role of conscious awareness in modulating affective responding, but also have implications for models of selective attention (Kihlstrom, 1987), for neuroanatomical models of unconscious information processing (Dixon, 1981; Winson, 1984), and for research on the affect-cognition relationship (Bornstein, 1989a).

Although most psychologists accept the notion that subtle, unverbalizable cues (i.e., unattended stimuli) influence affect, cognition and behavior (Kihlstrom, 1987; Lewicki, 1985; Nisbett and Wilson, 1977), the extent to which stimuli perceived without awareness exert these effects remains controversial. Much of the controversy surrounding subliminal perception research has to do with the degree to which operational definitions of "lack of aware-

ness" meet minimal criteria of scientific acceptability (Bornstein, 1989b; Bornstein and Masling, 1984; Dixon, 1981; Holender, 1986; Merikle, 1982). Because no single measure of stimulus awareness has satisfied researchers in different fields, no universally accepted definition of "lack of awareness" has been devised (see Holender, 1986 and commentaries). Given the disagreement among researchers regarding the assessment of stimulus awareness, recent research in this area (e.g., Bornstein et al., 1987) has used multiple measures. A combination of recall, recognition and discrimination tasks seems a conservative and rigorous method of assessing awareness of briefly exposed stimuli (see Bornstein and Masling, 1984).

Systematic investigations of the effects of stimuli perceived without awareness have been conducted by Zajonc and his colleagues (e.g, Kunst-Wilson and Zajonc, 1980; Wilson, 1979), and by Silverman and his colleagues (see Silverman, 1983; Silverman, Lachmann, and Milich, 1982). Silverman's (1983) subliminal psychodynamic activation (SPA) method is probably the most widely-used paradigm for investigating subliminal phenomena; more than 100 SPA studies have been conducted to date (see Silverman, 1983). Unfortunately, while the SPA method has produced a number of provocative findings, serious methodological issues have been raised about this paradigm (Balay and Shevrin, 1988; Bornstein and Masling, 1984). For example, because Silverman's measures of responding to subliminal stimuli have not always been fully defined, it is difficult to know which aspects of (for example) "irrational thinking" (a dependent variable used in a number of SPA experiments, e.g., Silverman, 1966) are sensitive to subliminal stimulation and which are not. The validity of some of Silverman's dependent measures has also been challenged by several critics (e.g., Balay and Shevrin, 1988; Haspel and Harris, 1982).

Furthermore, Silverman's efforts to define and assess stimulus awareness have not always satisfied critics (Bornstein and Masling, 1984). Unless extremely stringent criteria are used to define and assess stimulus awareness, there is always the possibility that subjects in these studies have some knowledge of stimulus content, but are unwilling to guess based on partial cues (Holender, 1986; Merikle, 1982). Rather than make an error, subjects may report that they have seen nothing.

Finally, a number of researchers have questioned Silverman's choice of SPA control stimuli (see Bornstein and Masling, 1984). Silverman's most frequently used experimental message is MOMMY AND I ARE ONE, but a common control message in these studies – PEOPLE ARE WALKING – is dissimilar not only in content, but also in complexity, overall length, number of words and number of letters. Thus, while Silverman's work has been heuristic, many investigators remain unconvinced of the rigor of his method and his interpretations of his results.

The present study was designed to correct several flaws in the usual SPA

paradigm. Subjects were divided on one personality variable – orality – and were tachistoscopically exposed either to a negatively toned experimental message designed to arouse fears of abandonment and rejection (NO ONE LOVES ME), or to a neutral control message (NO ONE LIFTS IT). The control message was designed to be physically similar to the experimental message: the number of words, the number of letters in each word, and 7 of the 12 letters were identical. The pattern that these messages make on the retina is, therefore, quite similar. Stimuli were exposed at either 4 ms or 200 ms durations. Thus, this experiment used a 2 × 2 × 2 between-subjects design (high versus low orality; experimental versus control message; 4 ms versus 200 ms exposure duration).

Although previous research has demonstrated that stimuli presented for 4 ms are not recognized or discriminated from unfamiliar stimuli at better-than-chance levels (Bornstein et al., 1987; see also Silverman, 1983), we nonetheless used three separate measures to assess stimulus awareness: (1) an open-ended inquiry in which subjects were asked to report what they had seen (the recall test); (2) a multiple choice recognition test, repeated twice for each subject because research in signal detection (e.g., Green and Swets, 1966) suggests that the second guess might be more accurate than the first in such situations; and (3) two discrimination tests in which subjects viewed pairs of slides exposed for 4 ms. In the first discrimination test, the subject was asked to differentiate between experimental and control messages exposed five times for 4 ms each. In the the second discrmination test, the subject attempted to distinguish control and experimental stimuli from blank slides under these conditions. To be sure that the discrimination tests were sensitive to subjects' awareness of even minimal stimulus cues (see Bornstein, 1989b; Merikle, 1982), 30 trials per subject were used in each discrimination test.

Method

Subjects

Subjects were 84 male undergraduate students at SUNY-Buffalo, who participated in the experiment to fulfill a course requirement for Introductory Psychology.

Procedure

One male experimenter – a 24-year-old undergraduate Psychology Honors student – ran all subjects. He did not know their orality scores, the exposure durations used, nor which stimuli had been loaded into the tachistoscope by a second experimenter.

The experiment consisted of three phases: (1) an initial prescreening session in which 30–35 subjects at a time were given the Group Rorschach test (Masling, 1986); (2) tachistoscopic presentation of stimuli and recording of electrodermal responses (EDRs); and (3) posttest assessment of stimulus awareness. A summary of the experimental procedures is presented in Table 1.

Prescreening of Subjects

Previous research has shown that subjects who report many oral images on the Rorschach test perceive others accurately, yield to the opinions of others in a group conformity situation, and show greater EDR changes than nonoral subjects in response to warm versus cold treatment by a confederate (Masling, 1986). Oral dependent subjects are extremely cooperative and compliant in the experimental setting (Bornstein and Masling, 1985) and in the clinical situation (Greenberg and Bornstein, 1989). In addition, high oral subjects show marked dependent and help-seeking behaviors in both experimental and clinical settings (O'Neill and Bornstein, in press; Shilkret and Masling, 1981). Overall, oral dependent subjects: (1) are very concerned with the opinions of other people; (2) seek nurturant, protective interpersonal relationships; and (3) are willing to go to great lengths to avoid being rejected and abandoned by significant others (see Masling, 1986, for a summary of studies in this area). We thought it likely, therefore, that high oral subjects would be particularly sensitive to the message NO ONE LOVES ME, which should arouse in them fears of abandonment and rejection.

Table 1

Summary of Experimental Procedures

Prescreening of Subjects
Administration and scoring of Rorschach orality measure
Experimental Procedures
Hookup of subject to physiological recording equipment
Initial instructions
(Physiological recording begins)
10-minute rest period
Final prerecorded instructions
Four exposures of experimental or control picture-phrase combination
(Cessation of physiological recording)
Posttest measures
Recall task
Recognition task
Discrimination test to new subjects
Debriefing of subject

In the Group Rorschach, subjects are asked to provide three responses each to Cards I, II, III, VIII and X, and two responses each to the other five cards. Subjects who provided fewer than 20 of the 25 required responses were not used in the study. Scoring for oral content followed the suggestions of Schafer (1954), as modified by Masling, Rabie, and Blondheim (1967). Interrater reliability was determined by having two raters independently score a randomly selected sample of 30 Rorschach protocols containing a total of 719 responses. The two sets of scores yielded a Pearson correlation coefficient of .91, and a Kappa coefficient (Spitzer, Cohen, Fliess, and Endicott, 1967) of .80. Following the procedure used successfully in previous experiments (see Masling, 1986; Shilkret and Masling, 1981), subjects who reported four or more oral responses were designated "high oral," while those who reported two or fewer such responses were classified as "low oral."

Stimuli and Apparatus

Tachistoscopic presentation of stimuli took place in an electrically-shielded, sound-deadened chamber, 2.5 × 1.8 × 1.5 m in size. Subjects were seated upright in a lounge chair while their behavior was continuously monitored by a wall-mounted video camera and an audio intercom system. Electrodermal activity was detected by Beckman Ag-AgCl electrodes (surface area = .8 cm^2), with cream composed of .05M NaCl in Parke-Davis unibase. The skin conductance electrodes were placed on the thenar and hypothenar eminences of the subject's nondominant palm. Skin conductance was detected by a constant voltage skin conductance coupler designed by Lykken and Venables (1971), and was amplified and recorded by a Grass Model 7 polygraph. Respiration was assessed by a Phipps and Bird chest pneumograph connected to the polygraph. EDRs resulting from movement or respiratory artifact were not scored.

Stimuli were presented via an electronically-controlled Scientific Prototype 3-field tachistoscope. For the experimental subjects (n = 42) the stimuli consisted of: (1) a drawing of several young men talking in the background while a solitary young man in the foreground looks downcast; and (2) the phrase NO ONE LOVES ME, presented in that order. The control subjects (n = 42) were shown: (1) a drawing similar to the experimental scene, except that flowers replaced the human figures in the same positions and same vertical stance; and (2) the phrase NO ONE LIFTS IT, in that order.

Presentation of Stimuli

Two to four weeks after the initial session in which the Rorschach test was administered, high and low oral subjects (i.e., subjects who reported at least

four oral responses or no more than two oral responses) were asked to return for a second experimental session. The following prerecorded instructions were given to subjects:

> In this part of the study, you will be asked to look at flashes of light that are pictures and phrases very quickly exposed. What we would like you to do is simply sit and relax for 10 minutes while we calibrate the machinery and take some initial physiological readings. Although the chamber is soundproof, we will be monitoring you on camera, and the intercom system allows you to communicate with us at any time by just talking. At the end of 10 minutes we will ask you to look into the eyepieces in front of you, focusing your vision on the dot in the center of the screen. We will let you know over the intercom when we want you to begin looking into the eyepieces. While you are looking into the eyepieces, a series of pictures and phrases will be shown. It is important that you pay close attention. While some subjects are able to see these pictures and phrases, others are not, so it is important that you keep looking into the eyepieces until we tell you that the procedure is over. As soon as it is over, we can discuss the content of the pictures and phrases that you saw, as well as the physiological readings that we have taken.

The electrodes and respirometer were attached to the subject, and the tachistoscope was then placed on a table directly in front of him, requiring only minimal movement for the subject to look directly into the eyepieces of the apparatus.

Half the subjects were assigned to subliminal (4 ms) conditions and half the subjects were assigned to supraliminal (200 ms) conditions. Thus, the 42 high oral subjects were distributed as follows: 10 to the subliminal/experimental message group; 9 to the supraliminal/experimental message group; 11 to the subliminal/control message group; and 12 to the supraliminal/control message group. The 42 low oral subjects were distributed as follows: 11 to the subliminal/experimental message group; 12 to the supraliminal/experimental message group; 10 to the subliminal/control message group; and 9 to the supraliminal/control message group.

A laboratory computer controlled exposure duration and inter-stimulus interval. Stimuli were presented five seconds apart. For each message-picture sequence, a centering dot appeared first, followed by a drawing, followed by a phrase. The centering dot then reappeared in the middle of the screen and remained there until the stimulus field was again illuminated. Subjects were exposed to four trials, each of which contained the dot, the picture and the phrase. Half the subjects were exposed to the flowers/NO ONE LIFTS IT sequence, and the other half were exposed to the people/NO ONE LOVES ME sequence.

Posttest Measures

Following presentation of the stimuli, the experimenter reentered the chamber and asked the subject to try to describe the phrase or drawing that

had just appeared in the tachistoscope (the recall test). Subjects were then reminded that a phrase and drawing had appeared on the screen, and were told that the phrase was included in a list of 25 phrases given to them. They were asked to try to select the correct phrase from that list (the recognition test). After selecting a phrase, subjects were asked to try a second time to pick the correct phrase. To test for the presence of partial cues, many of the phrases in the recognition test were constructed to look similar to the original message. Five of the phrases began with the word NO, five had ONE as the second word, nine used the letter L as the first or second letter of the third word, and the last word was either ME or IT in seven of the alternatives. As a check on possible hypotheses that an undergraduate subject might have constructed about the experiment, we added several phrases that a student in Introductory Psychology might expect a psychologist to include in a study of this type.

The recall and recognition tests were used for the 84 subjects who participated in the entire experiment. The third measure of awareness – the discrimination test – was administered only to a new sample of subjects who had not participated in any other phase of the experiment. In Discrimination test 1, 10 subjects were shown 30 pairs of experimental and control phrases five times each at 4 ms exposure durations; order of presentation was random. Following presentation of each stimulus pair, subjects were asked whether the experimental phrase had appeared first or second. In Discrimination test 2, 10 subjects went through an identical procedure, again with stimuli randomly presented, with the stimulus pairs this time consisting of a blank slide and one containing either the control or experimental phrase. The subject's task was to determine whether the message appeared first or second in each slide pair.

Scoring of Physiological Data

Both basal (i.e., tonic) and spontaneous EDRs were recorded during the 10-minute baseline rest period and throughout the message exposure trials. Baseline tonic skin conductance levels (SCLs) were calculated: (1) at the start of the 10-minute rest period; (2) following the rest period, but before the start of the prerecorded instructions; and (3) after the instructions but before the start of the message exposure trials. The mean tonic SCL during the instructions period served as the baseline measure of tonic electrodermal responding. The number of spontaeous fluctuations per minute during the prerecorded instructions period was calculated for each subject and served as the baseline measure of spontaneous electrodermal responding.

All physiological data were scored independently by two raters, one of whom was blind to all information regarding experimental conditions. Reliability

in scoring tonic SCL was determined by calculating Pearson correlation coefficients compairing the two raters' scores for all 84 subjects. Reliability in scoring tonic SCL was .92. For spontaneous EDRs, interrater reliability was again determined by calculating Pearson correlation coefficients between the two raters' scores (i.e., the number of spontaneous fluctuations per minute) for all 84 subjects. Reliability in scoring spontaneous EDRs was .88. After interrater reliability was determined, disagreements in EDR scoring were resolved through discussion.

Results

Rorschach Orality Measure

Mean Rorschach orality score for high oral subjects (n = 42) was 5.46 (SD = 1.11), while the mean orality score for low oral subjects (n = 42) was 1.59 (SD = 0.67).

Electrodermal Responding

A change in skin conductance of .1 umho or greater was scored as a spontaneous EDR. Tonic SCL was defined as the mean SCL during the message exposure trials. This mean was derived by averaging eight samples of skin conductance collected during the message exposure period. Two samples were taken during each of the four trials, one in the middle and one at the end of each trial. No significant effects for spontaneous EDRs were found. Therefore, all further analyses refer only to tonic SCLs.

One-way ANOVAs of the mean tonic SCL among the eight experimental groups were calculated for three phases of the baseline period, to ascertain that initial SCLs did not differ across groups prior to message exposures. These one-way ANOVAs revealed no differences in tonic SCLs during: (1) the initial 10-minute rest period, F (7, 82) = 0.87, NS; (2) the baseline (pre-instructions) period, F (7, 82) = 1.02, NS; or (3) the baseline (post-instructions) period, F (7, 82) = 0.40, NS.

A 2 × 2 × 2 ANCOVA of the change in tonic SCL in the eight experimental groups from baseline to message exposure period was performed with initial (baseline) SCL used as a covariant. This ANCOVA revealed a significant effect of message exposure duration on tonic SCL, F (1, 82) = 3.97, $p < .05$; and a significant message content by exposure duration interaction, F (1, 82) = 4.30, $p < .04$. There was no main effect of orality on tonic SCL, nor any interactions of orality with any other variable. The mean changes in tonic SCL for the experimental and control groups at both exposure durations (collapsed across orality) are presented in Table 2. A one-way ANOVA

Table 2

Changes in Mean Tonic Skin Conductance Level (umho) for the Four Experimental Groups from Baseline to Message Exposure Period

Group	*N*	*Change in Skin Conductance (umho)*
Subliminal exposure - experimental message	21	+.80 (.50)
Supraliminal exposure - experimental message	21	−.60 (.26)
Subliminal exposure - control message	21	−.15 (.26)
Supraliminal exposure - control message	21	−.85 (.41)

Note: *SD*'s for change in tonic skin conductance are in parentheses.

with Neuman-Keuls probing procedure comparing change in tonic SCLs in the four groups in Table 2 revealed that subjects exposed to the experimental message at the 4 ms exposure duration showed significantly greater changes in SCLs than subjects in the other three groups, $F(3, 80) = 3.83$, $p < .01$. Change in SCL from baseline to message exposure period did not differ among the other three groups.

Assessment of Awareness

None of the subjects who were asked to recall the message could supply even a fragment of the phrase. In fact, the typical subject claimed that the apparatus must have broken because he was certain that no messages had appeared on the screen. On the multiple choice recognition test, two of the original 44 subjects (5%) in the 4 ms condition were able to identify the correct phrase – one on the first trial, one on the second trial; one correctly choosing the experimental phrase, and one correctly identifying the control phrase. Both subjects (along with the one subject who could not correctly identify the target phrase in the 200 ms condition) were dropped from the study. By chance alone, two opportunities to select the correct phrase from a list of 25 phrases should result in 8% of the subjects choosing correctly. Our results do not differ from this chance level. Thus, both the recall and recognition tasks indicate that the 4 ms stimuli were presented below the level of conscious awareness. Table 3 gives the frequency of selection of different phrases used in the recognition task by subjects in the 4 ms experimental and 4 ms control conditions. Perusal of Table 3 confirms that subjects' responses showed no evidence of responding to partial cues.

Discrimination Tests

Chi-square tests assessing the accuracy of each individual subject's responses demonstrated that no subject in either discrimination task performed either

Table 3

Frequency of Selection of Target and Non-Target Messages in the Recognition Task by Subliminal-Experimental and Subliminal-Control Subjects

	Frequency of Selection	
Phrase	*Experimental Ss*	*Control Ss*
No one loves this	2	1
This is an experiment	7	8
We are alone	1	2
These words make no sense	1	2
I am alone	4	5
No one lifts it[1]	1	1
I am nervous	2	2
I am not alone	2	0
Your mind can read this	3	2
Everyone loves me	1	0
This study makes me nervous	2	2
No one loves me[2]	1	0
I want to stay	1	0
No one reads this	2	1
We are one	2	4
I am anxious	2	3
No one leaves me	1	0
This study is boring	2	1
Everyone lifts this	2	0
These words make sense	0	2
No one sees me	0	0
I want to leave	1	1
We are not alone	1	1
I am calm	2	5
No one reads it	1	1

Note: [1]control phrase; [2]experimental phrase. One subject in the 4 ms-experimental condition and one subject in the 4 ms-control condition correctly identified the target message. In addition, one subject in the 4 ms-experimental condition selected the control message in the recognition task.

better or worse than chance. In Discrimination test 1, the mean number of correct responses was 15.6 (52%). Overall, subjects correctly discriminated experimental and control stimuli in 156 out of 300 slide pairs, which does not differ significantly from chance level, χ^2 (1) = 0.49, NS. The best subject was able to discriminate 19 of the 30 pairs (63%) correctly, while the worst subject obtained 11 correct responses (37%).

In Discrimination test 2, the mean number of correct responses was 16.1 (54%). Overall, subjects correctly discriminated stimuli and blank slides in 161 out of 300 slide pairs, which does not differ significantly from chance level, χ^2 (1) = 1.61, NS. The best subject was able to discriminate 20 of the 30 pairs (67%), while the worst made 12 correct discriminations (40%).

Discussion

The present results demonstrate that significant, measurable changes in electrodermal responding result from tachistoscopic exposure to stimuli that subjects are unable either to recall or recognize. While the message NO ONE LOVES ME, shown for 4 ms, resulted in increased EDRs, neither 200 ms exposure to this message, nor 4 ms or 200 ms exposure to a neutral control message produced an EDR increase from baseline to message exposure trials. Our results thus demonstrate that emotionally relevant stimuli perceived without awareness have predictable, measurable effects on autonomic arousal. Because only the experimental message presented subliminally resulted in a significant increase in skin conductance, it is evident that both message content and exposure duration determine subjects' responses to tachistoscopically-presented drive-related stimuli (Bornstein, 1989b, 1990; Silverman, 1983).

Our use of EDR as a dependent measure helps to resolve an issue raised about earlier SPA studies, namely, incompletely described measures of responding to subliminal stimuli (Bornstein and Masling, 1984). Most important, we avoided the problems of self-report and self-presentation bias that have plagued SPA experiments by using a dependent measure that does not depend on subjects' verbal reports. Thus, the present study solves many of the methodological problems that have characterized SPA research, and has produced strong evidence that subliminal SPA stimuli produce significant effects on responding.

The present results support Silverman's (1983) hypothesis that drive-related SPA stimuli must be presented subliminally in order to produce significant behavioral effects. These results are also consistent with Bornstein's (1989b) hypothesis that stimulus awareness inhibits responding to drive- and affect-related stimuli. Furthermore, because drive-related stimuli presented for 4 ms produced significantly stronger effects on electrodermal responding than identical stimuli presented for longer durations, a partial cue interpretation of the present findings is not tenable. As Bornstein (1989b) notes, while a partial cue hypothesis can explain comparable effects for briefly-presented stimuli and stimuli presented for longer exposure durations, this hypothesis cannot accommodate the finding that briefly-presented stimuli exert significantly *stronger* effects on behavior than stimuli presented for longer durations. The most parsimonious explanation for this result is that stimulus awareness inhibits responding to drive-related stimuli (see Bornstein, 1989a, 1989b, 1990, for detailed discussions of this issue).

The present results are also consistent with Fowler, Wolford, Slade, and Tassinary's (1981) finding that subjects extract meaning from verbal messages without awareness of the structural or phonetic properties of the stimulus (cf., Holender, 1986). Consistent with these results, Kunst-Wilson and Zajonc

(1980) and others (e.g., Bornstein et al., 1987; Mandler, Nakamura, and Van Zandt, 1987) found that subjects respond affectively to stimuli that cannot be recognized (see Bornstein, 1989a, for a review of these studies). Similarly, Bargh and Pietromonaco (1982), Erdley and D'Agostino (1988) and others found that subliminal presentation of trait words significantly influences subjects' perceptions of target persons about whom they have little previous information (see Bornstein, 1989b, for a review of these studies). Thus, as Kihlstrom (1987) notes, "It may be possible to perform meaning analyses on information which is not accessible to conscious awareness, by means of automatized, unconscious procedural knowledge. This does not mean that cognitive activity is not involved in such judgments and inferences; it only means that the cognitive activity, being automatized, is unconscious in the strict sense of that term and thus unavailable to introspective awareness" (p. 1447).

Contrary to our experimental hypothesis, the personality dimension of orality was not a significant factor in predicting subjects' responding to tachistoscopically-presented stimuli. While it is impossible to ascertain from these data the reasons for this negative result, it is clear that the experimental message was not differentially anxiety-producing to oral dependent and nonoral subjects. It may be that the message NO ONE LOVES ME was sufficiently anxiety-producing in all subjects that personality differences in responding to this message were obviated. Fears of abandonment and rejection are not, of course, limited to oral dependent individuals (although these issues are particularly prominent in oral dependent people). Thus, the message NO ONE LOVES ME might have produced a kind of "ceiling effect," arousing nonoral subjects so much that there was little room for high oral subjects to show even greater levels of arousal. Further research on the content of subliminal themes relevant to different personality types is clearly indicated (Bornstein and Masling, 1984).

At any rate, to the growing body of literature on perception without awareness must now be added the finding that subliminal exposure of certain messages results in significant changes in EDR, while supraliminal exposure of identical messages yields no such effect. Attention should now be turned to investigating the processes by which subliminal messages exert their effects. While input (i.e., stimulus) and output measures (i.e., dependent variables) have been specified in subliminal perception studies, the links between these events remain essentially unknown (although several intriguing models have recently been offered; see Dixon, 1971, 1981; Kihlstrom, 1987; Winson, 1984; Zajonc, 1980). It would be useful now to investigate whether it is possible to produce reductions in autonomic responding via anxiety-reducing subliminal messages. Because recent research has demonstrated that repeated, unreinforced exposure to subliminal stimuli produces significant

enhancement in attitudes toward those stimuli (Bornstein, 1989a; Bornstein et al., 1987), the possibility that autonomic responding will be affected by repeated subliminal exposures warrants further study.

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