DOCUMENT RESUME

ED 137 683 CG 011 269

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TITLE	Social Modeling Influences on Pain Experience and Behaviour.
PUB DATE	Sep 76
NOTE	16p.; Paper presented at the Annual Conference of the American Psychological Association (84th, Washington, D.C., September 3-7, 1976)
EDRS PRICE	MF-$0.83 HC-$1.67 Plus Postage.
DESCRIPTORS	Communication (Thought Transfer); Emotional Response; Experimental Psychology; Observational Learning; *Patterned Responses; Psychological Patterns; *Psychophysiology; Research Reviews (Publications); *Role Models; *Sensory Experience; *Stimulus Behavior
IDENTIFIERS	*Pain Experience; *Social Modeling

ABSTRACT

The impact of exposure to social models displaying variably tolerant pain behaviour on observers' expressions of pain is examined. Findings indicate substantial effects on verbal reports of pain, avoidance behaviour, psychophysiological indices, power function parameters, and sensory decision theory indices. Discussion centers on how social models affect illness role-taking, alter emotional qualities of pain, and influence enactment of previously learned pain and illness behaviour. A recent investigation examining restrictions in communication networks among experimental participants is described. Hypotheses concerned the impact of a tolerant model, the additive effect of public disclosure of pain experience, and the effects of a coactive peer companion on personal distress. Findings indicated exposure to tolerant models substantially reduced pain reports and encouraged persistence to higher electric current intensities before describing them as unendurable and withdrew. Psychophysical scaling of the data indicated that the different forms of communication influenced power function exponents. They were smaller subsequent to exposure to a tolerant model indicating that fundamental properties of the shock experience were changed. Neither self-disclosure of preceived discomfort or a peer-companion subjected to the same experience produced changes in pain behaviour. The value of conceptualizing pain phenomena as components of complex social-behavioral transactions is discussed. (Author)

Social Modeling Influences on Pain Experience and Behaviour[1]

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In contrast to many traditional perspectives on pain experience and behaviour (reviewed in Melzack, 1973), which view them as imperative, reflexive sensory responses to noxious stimulation, increasing evidence indicates that the behavioural phenomena of pain are strikingly subject to the control of cognitive and social factors. In particular, evidence on the impact of the social environment indicates that pain behaviours are highly discriminative and that judgemental and decision-making processes are crucially involved. For example, in many instances, pain is recognized by the suffering person to be transitory or self-limiting and subject to control through behavioural adjustments in the form of escape from the source of pain or self-administration of various palliatives. In other circumstances, suffering individuals do not have at their command a means of obtaining relief and they must continue to endure distress resulting from injuries or disease states. This relative absence of control appears to intensify the degree of distress and suffering and can lead to even more desperate maneuvers to find relief (Averill, 1973; Craig & Best, 1976).

Communications to the effect that pain is being experienced, whether verbal or nonverbal, can be construed as attempts to solicit whatever relief and comfort may be available from others (Szasz, 1968). As the individual learns the responses of others to different forms of communication expressive of personal discomfort and pain, idiosyncratic styles become established. The considerable

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[1] Presented at the symposium "Psychology and Pain Control", Annual Convention of the American Psychological Association in Washington, D.C., September 3-7, 1976.

variety in styles of expressive communication, particularly in those instances where verbal and nonverbal signs of distress are disproportionate to the severity of tissue damage, tend to implicate the role of socialization processes. On the one hand, there is the stoical person, typified in the extreme by those who fail to avail themselves of medical help available to disrupt disease processes. On the other hand, there are those who purposefully or unwittingly use medical complaints of personal distress to effect personal objectives in the absence of organic pathology.

We have undertaken the task of attempting to understand some of the social and cognitive factors influencing and mediating pain behaviour by studying the impact of exposure to social models displaying variably tolerant pain behaviour. Since the behavioural aspects of pain seem so critical, the potential value of understanding their social determinants is clear. As Bandura (1969) notes:

> "virtually all learning phenomena resulting from direct experiences can occur on a vicarious basis through observation of other persons' behaviour and its consequences for them. Thus, ... one can acquire intricate response patterns merely by observing the performances of appropriate models; emotional responses can be conditioned observationally by witnessing the affective reactions of others undergoing painful or pleasurable experiences; fearful or avoidant behaviour can be extinguished vicariously through observation of modeled approach behavior toward feared objects without any adverse effects occurring to the performer....(p.118)

The three areas of psychological functioning influenced by modeling subsequently differentiated by Bandura (1969) suggest a conceptual structure for the study of the impact of socialization experiences on pain:

(1) Transmission of new patterns of behaviour. Ethnocultural differences in pain behaviour and attitudes towards sickness and health have been described frequently (e.g., Sternbach & Tursky, 1965; Weisenberg, Kreindler, Schachat & Werboff, 1975; Wolff & Langley, 1968; Zborowski, 1969), but investigations have been cross-sectional and longitudinal designs are needed. Similarities within different ethnocultural groups imply the operation of modeling processes wherein

others within the group serve as models and exert sanctions for what we would recognize as either adaptive cognitive, motor and social coping strategies in response to noxious stimulation, or for maladaptive behaviour inconsistent with organic pathology.

It must be recognized, however, that even within ethnocultural groups stereotyped as possessing highly characteristic patterns of response to pain there is a substantial range of individual differences. These intragroup individual differences may also be amenable to explanation through modeling theory. For example, an uncontrolled questionnaire study (Gentry, Schows, & Thomas, 1974) of chronic low back pain patients indicated they tended to have familial models for pain and/or major physical disabilities. Fifty-nine percent of their patients reported that at least one close family member suffered from either chronic low back pain or another debilitating physical disorder. By implication, other family members may serve as models for chronic pain behaviour. It should be noted in passing that the impact of a model on an observer is critically influenced by the consequences of the model's actions. The observer is far less likely to engage in modeled behaviour if there have been adverse consequences. Within cohesive groups, positive sanctions would exist for emulative behaviour, thereby encouraging behaviour that matches modeled styles and techniques for complaining of physical discomfort.

(2) The elimination of fears and inhibitions. To the suffering person, the essential components of pain are its emotional qualities. Melzack and Torgerson (1971) identified words used to describe affective qualities as those describing the tension, fear and autonomic properties of pain experiences such as exhausting, sickening, fearful, terrifying, grueling, and vicious. Ample evidence indicates that emotional factors, whether personality predispositions or situation-specific responses, independent of noxious stimulation, can accentuate or inhibit pain

experiences and behaviour (Martinez-Urrutia, 1975; Melzack, 1973; Sternbach, 1974). Studies of vicariously conditioned emotional responses (e.g., Berger, 1962; Craig & Lowery, 1969) and vicarious extinction of avoidance behaviour (Bandura & Menlove, 1968) demonstrate the impact of the experiences of others on an observer's affective behaviour. With respect to clinical pain behaviour, models could determine the quality and degree of anxiety and affect experienced and the degree of distress tolerated before relief is sought. Studies of exposure of patients to real or symbolic models manifesting realistic coping responses to painful stimulation generally indicate beneficial effects in children receiving injections (Vernon, 1974), undergoing surgery in hospitals (Melamed & Seigel, 1975) and receiving dental treatment (Gordon, Terdal & Sterling, 1974) and adult and child patients in an intensive burn unit (Fagerhaugh, 1974). In part, the models can be seen as providing realistic information on the reactions of others to threatening stimuli. Such information would allay inaccurate expectations and relieve the severity of distress (Johnson, 1973).

(3) The facilitation of preexisting modes of response. In this instance, models serve as discriminative cues for the use of previously learned responses that would have beneficial value for the individual, or maladaptive behaviour having short term gain but long term adverse consequences (drug addiction, assuming the sick role, compensation dependencies). Some relevant adaptive behaviour would be the process whereby one seeks and effectively utilizes beneficial resources, how to cooperate during treatment to minimize danger and noxious effects (Johnson & Leventhal, 1974), and the use of behavioural skills incompatible with pain (Fordyce, 1976). Fagerhaugh (1974) underscores the potential adaptive impact of models in describing the essential role of other patients in helping new patients endure pain and control pain expression. She states:

"The patients on a burn unit represent a group who are in various stages of the burn and pain trajectories, in open view of each other, and who spend a rather long period together in an enclosed space. These conditions give every patient a chance to rehearse and interpret his own illness and its pain trajectory and to compare his state to that of others. Through these activities he learns the norms and limits of pain expression and relief associated with the various phases; the various methods of tolerating pain; and the complications that may alter his pain trajectory." (p. 647).

Turning to work in our laboratory, the earliest studies demonstrated that modeling influences had a very impressive impact on pain behaviour. The basic experimental paradigm involves having volunteer university student subjects accept shocks in an ascending series of the psychophysical method of limits while exposed to an experimental confederate ostensibly undertaking the same task but simulating tolerance or intolerance. Both modeling roles have strongly affected expressions of discomfort and pain and willingness to accept increasing levels of shock intensity. (Briefly reviewed in Craig, 1975.) For example, in our earliest study (Craig & Weiss, 1971), a control group, not exposed to a model, identified a mean current of 6.35 mA as painful, whereas subjects paired with an intolerant model accepted only 2.50 mA before describing it as painful, and those exposed to a tolerant model characterized 8.65 mA as painful.

I'd like to review recent work that elaborates on some of the complexities of the modeling process. In previous studies, the communication network among experimenter, model and subject was completely open, with all parties in full knowledge of when shocks were being administered and all ratings of the severity of the discomfort experienced. The procedures have been similar to clinical applications of participant modeling to phobic and inhibited behaviour. Here, the model demonstrates coping skills in joint performance while clients work through graduated tasks over a period of time (Bandura, Jeffery & Wright, 1974). With this technique, as in our studies, clients are exposed to a great deal more than the example of the model. An important component would be the potential for competition, which at its extreme would involve the individuals refusing to risk accusations of inferiority for failing to match a model's performance. Competitive challenge was shown to influence tolerance to pressure pain by Lambert, Libman and Poser (1960). A group of Jewish subjects who were told that Jews could not tolerate pain as well as Protestants increased its mean tolerance score in contrast to another Jewish group not receiving this instruction and Protestant subjects provided with a similar manipulation.

Because subjects in our studies were not only familiar with the model's performance, but immediately revealed their own ratings there has always been the challenge of comparing favourably or even appearing courageous. It seemed possible to remove some elements of this implicit competitive challenge by allowing subjects to make ratings while undergoing shock stimulation without communicating them to either the model or experimenter. Contrasts of subjective ratings and pain avoidance behaviour among groups which varied as to the form of communication permitted provided a test of several hypotheses, including one that requiring immediate self-disclosure of pain ratings constituted a critical component of pain behaviour in our studies.

Our research program has also included magnitude estimation scaling procedures (Craig, Best & Ward, 1975) because of their sensitivity to the range of individual experience and potential for quantification of covert psychological experiences (Grossberg & Grant, 1976). Since early work by Stevens, Carton and Shickman (1958), investigators consistently have reported that the perceived magnitude of experimentally induced pain (Ψ) grows as the physical value of the stimulus (ϕ) raised to some power (η), or

$$\Psi = \alpha\phi^{\eta}.$$

This has been the case with electric shock (Ekman, Frankenhauser, Levander & Mellis, 1964), cold pressor pain (Hilgard, 1967), and ischemic pain (Hilgard, 1969) induced through the submaximum effort tourniquet technique (Smith, Egbert, Markowitz, Mosteller & Beecher, 1966).

Fifty unselected women university students underwent the following procedure. The subject was seated to the model's left, with a wooden screen blocking their view of each other, and another separating both the subject and the model from the experimenter, thereby eliminating nonverbal communication. They were to rate the discomfort induced by gradually increasing electric shocks by assigning magnitude estimations to them and by moving a sliding metal indicator along a numbered wooden bar attached to the screen in front of them. The bar was marked at equal intervals from zero to seventeen. A zero rating was described as appropriate when nothing was felt, and a rating of one was designated as indicating the shock was detectable. Higher ratings were to be used to specify increased discomfort and pain. Following open ended scaling procedures devised by Hilgard and his associates (Hilgard, Ruch, Lange, Lenox, Morgan & Sachs, 1974), a rating of ten was to be used to specify the point at which they would like to stop accepting shocks; however, in this initial instruction, they were told, "We want you to go on taking shocks for as long as possible after you have reached this level, but the decision is yours to stop at any time." After moving the slide indicator they were to write the number selected on a sheet of paper provided. Shocks could be discontinued at any time by opening the circuit with a knife switch on the table before them. A standard number (34 500 millisecond) of shocks was presented for each of three series. Each shock was delivered through concentric electrodes on the forearm (Tursky, Watson & O'Connell, 1965) following standard procedures described in Craig, Best and Ward (1975). Shocks increased by .5 milliamperes on successive trials.

Communications regarding pain ratings and current intensities accepted were controlled according to the structure of the following groups.

(1) Interactive Tolerant Modeling. Consistent with procedures in earlier studies

(Craig & Weiss, 1971; Craig, Best & Ward, 1975) both the subject and model verbally declared their ratings after each shock. The female model presented herself as tolerant by characterizing the shocks as 75% of the subjects' ratings to the nearest integer.

(2) Subject Verbal Only. The experimenter's instructions simply stated, "I see that you two fall into an experimental group such that the person on my right (the subject's name was stated here) will say her ratings out loud, as well as moving the indicator and writing them down on the answer sheet. The person on my left will remain silent, but still use the indicator and write down her answers." Public disclosure of ratings in front of a peer, but without information regarding the partner's performance, were expected to promote self-presentation as pain-tolerant.

(3) Model Verbal Only. The same instructions were used to require the model to verbalize her ratings, with the subject remaining silent. This procedure conforms more closely to standard modeling paradigms where subjects do not interact with models. Because models' ratings were contingent on subjects' ratings (75%, as in group 1), a concealed mirror was placed to allow them to observe subjects' ratings on the slide indicator.

(4) Both Silent. Neither was instructed to verbalize following the initial instructions. This provided contrasts between the former experimental groups and a comparison group where subjects were coactive with a peer engaged in the same noxious task. There is some evidence indicating that in some circumstances (Epley, 1974) the presence of companions reduces aversive qualities of the setting. This group provided for a coactive peer, although they weren't mutually engaged in a task where joint cooperative activity would be more effective than individual effort. Since we have attributed the effects of this sequence of modeling studies to the communicative effects of the model's relative tolerance for the painful stimulation,

it seemed important to provide for a contrast between groups comparable in all respects other than whether or not there was evidence as to the behavioural response of the model to the threatening situation.

(5) Subject Active Only. The experimenter's further instructions indicated that "only the person on my right will be receiving shocks." Thus, the subject was to provide the usual ratings, but her partner was to remain silent. This group provided for a contrast of the effects of coactive and inactive companions.

Our primary data analysis involved analyses of variance on current levels endured, verbal ratings and derivative psychophysical indices across the five experimental groups and controls and over the three shock series. Power functions were fitted to the data of each subject using linear regression of the logarithms of the geometric mean magnitude estimate on the logarithms of the current intensities delivered. Separate analyses of variance were performed on exponents (η) and units of scale (α).

Figure 1 charts mean pain reports for the individual groups to those current intensities that were accepted by all subjects in a group. Subjects persisting in accepting shocks after others withdrew tended to use lower magnitude estimates, hence the means calculated on receding numbers for subsequent successive shocks would be biased in the lower direction and were therefore not included in this figure. The data clearly reflect effects of social influences with those exposed to the tolerant modeling procedures providing substantially lower pain reports and those in group one persisting to substantially higher levels of stimulation before anyone withdrew. The social influences appear to be cumulative on successive exposures, since differences between groups become greater as current intensities increase.

Table 1 provides data on a critical level of self-report, the level of shock provoking selection of the label "10", designating the degree of discomfort at which subjects would like to stop, and the ultimate current intensity they were able to endure, the shock tolerance level. There were substantial differences between the groups on both measures with the findings consistent across analyses, $Fs(4,40) = 7.28$ and 7.10, $p < .001$, for self-report (verbal "10") and shock tolerance, respectively. Means for shock tolerance underestimate actual tolerance in the groups to varying degrees because no shocks were delivered above 18.0 milliamperes in order to avoid tissue damage, and subjects in several groups reached that level (4, 0, 2, 1, and 0 in groups 1 to 5, respectively). Newman-Keuls analyses ($\alpha = .05$) of the significant main effect for groups indicated that group 1 (standard tolerant modeling) differed significantly from groups 2, 4, and 5 (the confederate did not enact the modeling role in these groups), and group 3 (model verbal) only differed from group 5 (subject shocked only). Consequently, the critical operative factor appears to have been providing consistent information to the effect that the model perceived the shocks to be at lower levels of discomfort. The subject's disclosure of perceived discomfort in front of a peer, without information as to the peer's experience, had no apparent effect. Propensities to present oneself favourably did not bias responses in the tolerant direction. However, given the slightly different pattern of differences between groups 1 and 3 and the other groups there is marginal evidence to suggest that some components of the interactive modeling role contribute ove and beyond the succession of exposures to the model, hence some competitive challenge factors may still have been involved.

Having a companion peer subjected to the same noxious experience, without information as to its affective consequences for the peer, did not produce any behavioural evidence of reductions in perceived discomfort, in contrast to having the peer present, but not coactive. Apparently, conjointly experiencing comparable discomfort with another person does not necessarily reduce pain.

While pain tolerance was stable, since trial effects were not significant ($p > .10$), current intensities provoking the "10" rating increased significantly, $F(2,80) = 4.74$, $p < .05$, suggesting a tendency to adapt to the current and to perceive it as less intense with time.

As noted previously, the magnitude estimates were subjected to linear regression analyses and the derived exponents (η) and units of scale (α) examined through analyses of variance. Figure 2 provides the log-log plot of the same data as in Figure 1 for intensities of 1.0 mA and greater. This was done to provide for discriminable shock, eliminating responses to current intensities that were not clearly detectable. Since a straight line function fits the data for individual groups, they are consistent with S.S. Stevens power law and the verbal reports can be subjected to quantitative analyses of the key values of this function, the exponent and the unit of scale.

Differences between groups in the unit of scale were not significant but groups differed significantly in the exponents of the power functions, $F(4,40) = 5.98$, $p < .001$). Newman-Keuls' analyses indicated that slope exponents for the two modeling groups (1 and 3) differed significantly ($p < .01$) from group 5 (partner inactive) with no other differences proving to be significant.

The theoretical significance of differences in the magnitude of the exponent for power functions is controversial. Usually the exponent is conceptualized as an index of the operating characteristics of sensory receptors, with separate sensory modalities characterized as possessing a "true" psychophysical function and factors producing variation in the power function constituting sources of noise or measurement error. On the other hand, demonstrations of the systematic impact of variations in experimental context on power functions (Birmbaum, 1974; Poulton, 1968; Ward, 1975) is leading to broader interpretations of the power than those based on narrow sensory assumptions. This perspective provides for the operation of a combination of perceptual and cognitive factors (Baird, 1970; Grossberg & Grant, 1976). Both perspectives would argue that the exponent describes the rate of growth of response magnitude. Given that the social modeling influence strategy changes the size of the exponent in the power function, fundamental properties of the experience appear to have been changed.

As Ward observes (1975), a major advantage of cognitive models of psychophysical judgement is that they are capable of explaining the successful scaling of continua, such as duration, length, distance, pain or electric shock, that do not have specialized sensory receptors. Since neurophysiological models of these judgemental processes cannot rely on descriptions of operating characteristics of sensory transducers, they are analogous to neurophysiological models of pain processes that presently rely on formulations of central mechanisms (Melzack & Wall, 1965).

Several other studies in this sequence have addressed themselves to the question, "what is the nature of the change in subjective experience induced by social influence variables?" Verbal reports are multidimensional (Melzack, 1975) and over determined; hence, controversy exists as to just what is changed through social influence. The application of signal detection theory to separate the impact of analgesic procedures on sensory sensitivity to painful stimulation (d') from response biases affecting willingness to report pain has been of considerable value. Based on studies in which placebo administration and direct analgesic suggestions produced changes in response bias, but not in sensory sensitivity to noxious stimulation, Clark and Goodman (1974) asserted that "cognitive control" strategies in general do not influence fundamental sensory qualities of pain, but merely reflect changes in the criterion for reporting pain. We have now completed several studies indicating that exposure to the model may influence sensory sensitivity as well as response biases. In the first (Craig & Coren, 1975), using shock stimulation below pain threshold, exposure to an intolerant model, always rating the shocks as producing more discomfort that the subject, led to increases in discriminability of the shocks. It appeared that social experiences could enhance vulnerability to noxious stimulation, thereby increasing a person's suffering. In two subsequent studies (Craig & Ward, 1976; Prkachin & Craig, 1976), using supra pain threshold shock through to endurance levels, sensitivity to the noxious stimulation was reduced by exposure to tolerant models, as indicated by decreases in the discriminability index. While there are problems in the application of signal detection theory to the study of pain (Chapman, 1975; Clark, 1974), it represents a substantial improvement over earlier methodologies and warrants broader application.

The research program briefly reviewed here attests to the value of conceptualizing pain phenomena as components of complex social-behavioural transactions. Individuals subjected to potentially painful stimulation apparently are engaged in a discriminative judgemental task with expressive behaviour predicted on characteristics of the social setting as well as on the characteristics of the focal noxious stimulation. Finally, fundamental characteristics of the noxious stimulation as perceived by the individual would appear to change as a result of the social influence. Further understanding of these processes could make a substantial contribution to our ability to reduce human suffering.

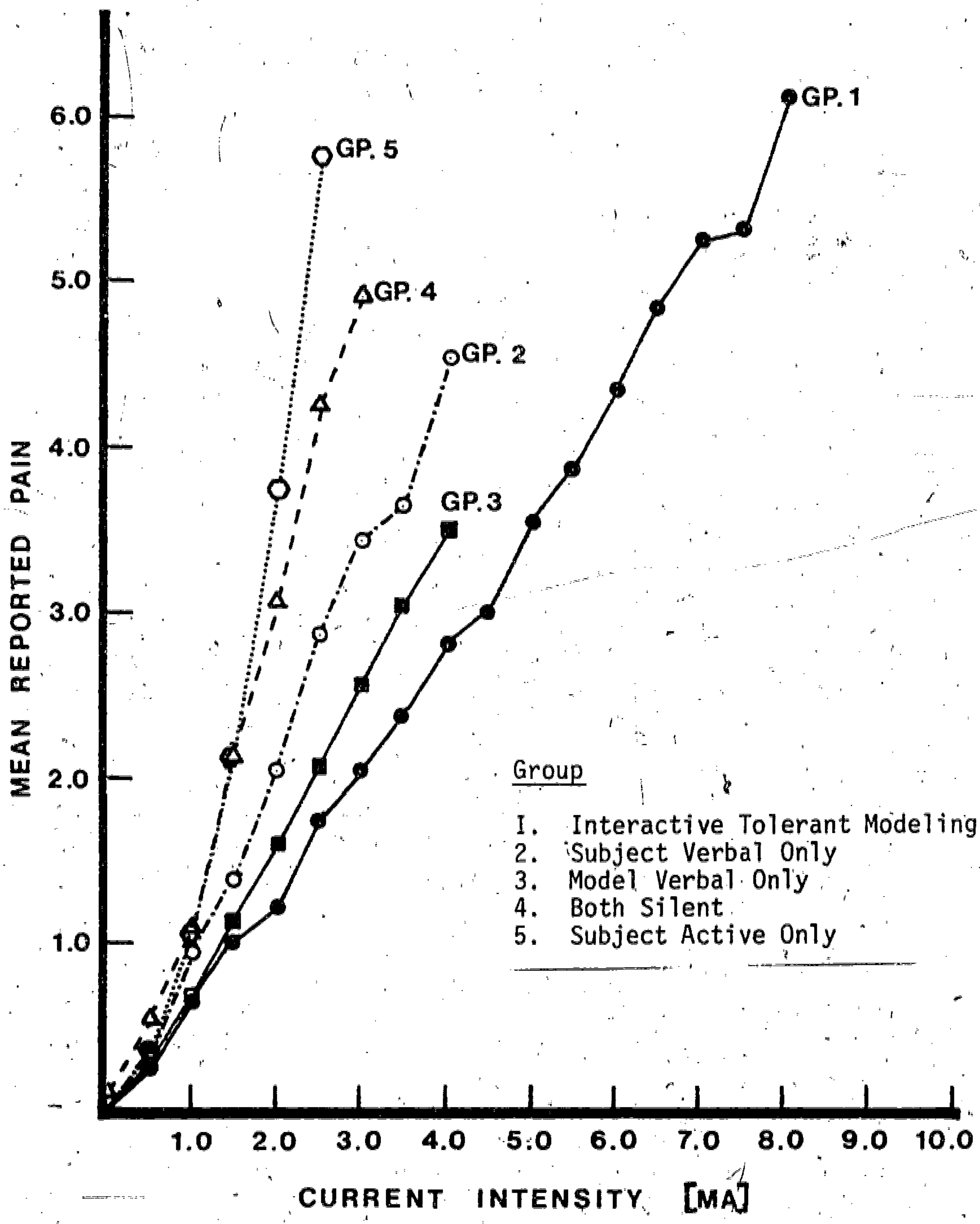

FIGURE 1. Mean reported pain to those current intensities accepted by all subjects (N = 10 per group).

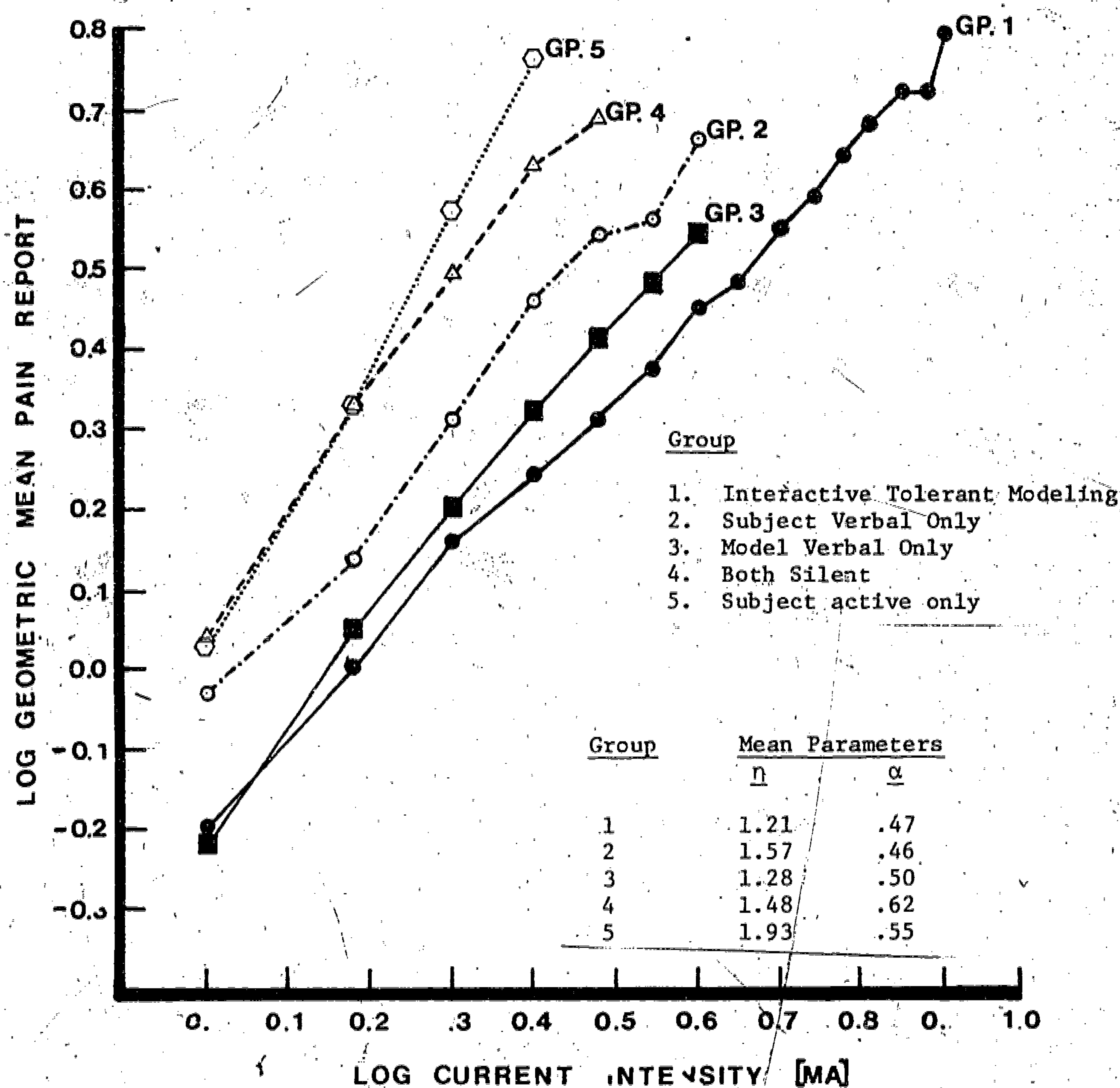

FIGURE 2. Log-log plot of the psychophysical function for the pooled data of reported pain against current intensity.