Perceived Control and Distraction in the Cold-Pressor Test

MICHAEL BENNETT
LARRY BOEHM*
Thomas More College

The cold-pressor test was used to evaluate the effectiveness of perceived personal control in the reduction of pain ratings. Forty-seven college students were divided into three groups. Participants in the perceived-control group were subjected to the cold-pressor test and were led to believe they could control the temperature of the water. Participants then rated the pain they experienced on a scale of 1–20. Their results were compared to a group using a distraction task (letter shadowing) and a traditional control group. Pain ratings for both the perceived-control and the distraction conditions were significantly \( p < .05 \) lower than the control group. The mechanism for this reduction in pain intensity may be the stress-reducing properties of perceived control and its mediation of stress in the pain experience.

From the moment the first child was born until the last person ceases to walk the earth, pain has been, and will be, an inherent part of the existence of humanity. Over the centuries considerable attempts have been made to understand and control pain; yet many answers lie undiscovered. Many research studies regarding pain perception and mechanisms of pain control (e.g., Loeser, 1989; Marino, Gwynn, & Spanos, 1989; McCaul & Malott, 1984) were conducted during the last 100 years.

Loeser (1989) postulated four conceptual levels for evaluating pain: (a) Nociception, which involves potentially tissue damaging thermal or mechanical energy impinging upon specialized nerve endings; (b) Pain, which is an unconscious mental interpretation of tissue damage; (c) Suffering, which is a negative affective response generated in higher nervous centers linked to stimuli such as pain, stress, anxiety, or fear; (d) Pain Behavior, which is simply any behavior generated by an individual that is understood to reflect the presence of the aforementioned components of pain as a whole. It is important to note that Loeser believes suffering is a component of, not just a result of, pain. Because factors such as stress influence the suffering of an individual, the suffering and, therefore, overall pain perception could be reduced by controlling these factors.

One method for decreasing stress in response to an aversive stimulus is personal control. Averill (1973) discusses three distinct types of personal control: (a) behavioral control, which is having direct control over the environment (stimulus modification); (b) cognitive control, or interpretation of events; and (c) decisional control, or having a choice among alternative events. These types of control have different effects on either inducing or reducing stress.

The most notable form of personal control in reducing the stress associated with an unpleasant stimulus has been behavioral control (Averill, 1973). When an individual can modify the nature of an aversive stimulus, whether by avoiding it or limiting its intensity, reduced stress reactions are shown (Averill, 1973). Because the process by which control was given to one group and not to others may have indirectly increased the stress levels in the no-control groups, Averill questioned the generality of this effect.

Corah and Boffa (1970) hypothesized that allowing participants to "escape" an aversive stimulus would produce lower discomfort ratings and reduced physi...
oretical arousal. Further, a sense of control was created in the choice condition by giving participants the option of pressing a button to end the aversive stimu-
sus. (This option was available in the "no escape" condition, but its use was discouraged.) Participants in the no-choice condition were instructed when to press the button, regardless of their discomfort. They hypothesized that giving participants a sense of control in a "no escape" condition would be as effective in discomfort and arousal reduction as in the "escape" condition. The results of their experiment supported both hypotheses. They found that participants in the choice group gave lower discomfort ratings and exhibited significantly lower skin conductance (lower arousal) than those in the no-choice group.

Corah and Boffa's (1970) data support the hypothesis that a sense of personal control over an aversive situation (behavioral control) will lead to lower stress. Applying this relationship to Loeser's (1989) model of pain, it is predicted that a sense of personal control should lead to a lower degree of perceived pain. This prediction is viable because personal control reduces stress, and stress reduction leads to a perceived decrease in the intensity of pain.

McCaul and Malott (1984) discussed the widely used method of distraction as a significant reducer of pain. There are two important principles that deal with the effectiveness of distraction in pain reduction. Distraction techniques that require more attentional capacity will be more effective because pain perception involves controlled, in addition to automatic, processes. Also, distraction has been found to have stronger effects on pain stimuli of low intensity. For the cold-pressor test (in which an individual places his/her hand or arm in a container of ice water, providing a graded painful stimulus), distraction has been proven to be effective only up to an immersion time of 2 min (McCaul & Malott, 1984). After this period of time the stimulus often becomes too intense and overrides the distraction task.

Previous studies indicate the distracting factor must be attentionally demanding to be effective in pain reduction. Thorn and Hansell (1993) administered the cold-pressor test to participants who were either given a specific time goal to stay immersed or just told to leave their hand in the water for as long as they could. They were not given a clock to look at, so those individuals who were given the time goal were required to count the time in their head. Although this is a mild form of distraction, it is not very attentionally demanding. There were no significant differences in reported pain.

Marino et al. (1989) studied the effectiveness of distraction versus imagery in pain reduction. The methods investigated were letter shadowing (a straightforward distraction technique) and self-propagated positive imagery (employed by participants to control their attention). Participants were subjected to the cold-pressor test. The results showed that distraction was as effective as imagery in reducing experimentally induced pain (Marino et al., 1989).

This effect has also been shown in other research (Devine & Spanos, 1990; McCaul & Malott, 1984). In each of these studies the cold-pressor test was used. It can safely be said that distraction techniques that are attentionally demanding are effective in reducing pain ratings with a mildly intense stimulus (McCaul & Malott, 1984). Given the effectiveness of distraction as a pain-reduction technique in the cold-pressor task, it can be used to gauge the effectiveness of other pain-reduction techniques.

There is support for the hypothesis that a sense of personal or behavioral control leads to reduced stress reactions and reduced levels of physiological arousal in response to an aversive stimulus (Averill, 1973; Corah & Boffa, 1970). According to Loeser's (1989) model of pain, stress is directly linked to the portion of pain by which the complete experience is perceived (suffering). If Loeser's theory holds true, an increase in an individual's sense of personal or behavioral control over an aversive stimulus should indirectly reduce the level of perceived pain by reducing the amount of stress produced in response to the painful stimulus.

The present experiment was designed to study the validity of this hypothesis. Namely, a sense of personal control over a painful stimulus (the cold-pressor test) should reduce pain ratings in response to that stimulus. In this study, participants were given the cold-pressor test and asked to rate the pain they experienced on a set scale. They were either given no pain-reduction technique (control), a distraction task to perform, or were led to believe they had control over the water temperature. If the findings of the previous studies are valid and generalizable, then the following effects should occur: (a) the distraction and the perceived-control groups should report lower mean pain ratings than the group given no pain-reduction technique, and (b) the distraction group and the perceived-control group should not differ significantly in their ratings.

Method

Participants

Forty-seven students (28 women, 19 men) from a small liberal arts college volunteered to participate in the study. Those students enrolled in psychology courses received extra credit for their participation.
The cold-pressor device consisted of a 5-gallon (18.93-L) rectangular tank insulated with 0.5-in. (1.27-cm) thick Styrofoam and covered in Formica (for aesthetic purposes). Attached to the tank was a small aquarium-style pump circulating the ice water between the cooling chamber, which contained the ice, and the immersion chamber, which contained only ice water. Underneath the immersion chamber was housed a nonfunctional heating coil that could be viewed by the participants. The two chambers were separated by a Plexiglas partition with holes at the bottom to allow for water circulation between the two chambers. A control box was used by members of the perceived-control group. There were two switches on the box. The switch on the right turned the circulation pump on and off, and the switch on the left was connected to an indicator light and a battery. The participants in the perceived-control group were told that it operated the heating coil, and when they switched the heating coil on, the light would come on indicating the heating process was engaged.

Rating Scale
The participants rated the level of pain experienced during immersion on a Likert-type scale that ranged from 0 (no pain) to 20 (most severe pain ever experienced). Other descriptors occurred at 1 (barely noticeable pain), 5 (moderate pain), 10 (so great I wanted to remove my hand), and 15 (excruciating pain). The participants were told the unmarked descriptors represented degrees of pain between the labeled markers. The scale was adopted from Spanos and Hewitt (1980).

Procedure
Participants were randomly assigned to one of three groups and tested individually. They were asked to place their right hand in the immersion chamber for 90 s. Because distraction was shown (McCaul & Malott, 1984) to be effective up to an immersion time of 2 min, this amount of time was selected in order to provide a moderately intense stimulus, but not so intense as to override the effects of the pain-reduction techniques. At the end of this time, participants were asked to remove their hand from the water, reminded their responses were confidential, and instructed to rate the pain they experienced. Following their participation, participants were debriefed and given the opportunity to ask questions regarding the experiment. Members of the control group followed this procedure without the use of one of the following pain-reduction techniques.

Results

<table>
<thead>
<tr>
<th>Group</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived control (n = 15)</td>
<td>10.60</td>
<td>1.59</td>
</tr>
<tr>
<td>Distraction (n = 17)</td>
<td>10.35</td>
<td>1.97</td>
</tr>
<tr>
<td>Traditional control (n = 15)</td>
<td>13.00</td>
<td>1.89</td>
</tr>
</tbody>
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Note: a vs. b significantly (p < .05) different

Members of the perceived-control group followed the basic procedure but were given the impression they could raise the temperature of the water. They were told that if the pain became too intense they could turn off the circulation pump (referred to as the “cooling” pump) and turn on the (nonfunctional) heating coil. Neither of these actions actually affected the temperature of the water during the 90-s immersion period.

Members of the distraction group also followed the same basic procedure, but were given a letter-shadowing task to perform while experiencing immersion. The shadowing task was similar to that used by Marino et al. (1989). The participants listened to a tape through a pair of headphones. Through the left speaker they were presented a voice reading a passage from a textbook, whereas the right speaker presented a set of spoken letters at a rate of 2 per s during the entire 90-s immersion. They were instructed to repeat the letters aloud as they were heard.

Discussion

The findings of this experiment support the hypothesis that a sense of personal control over an aversive stimulus leads to reduced pain ratings. Support was also found for positive effects of distraction in
reducing pain, as previously reported by Devine and Spanos (1990), Marino et al. (1989), and McCaul and Malott (1984).

The method of personal control employed in this experiment was a combination of behavioral and decisional control. Averill (1973) discussed findings showing that participants given decisional control over an aversive stimulus often reported increased stress due to the pressure of making a decision. The findings of the present study seem to contradict that notion. The absence of any real pressure to make the decision to turn on the "heating" device may explain this discrepancy. The presence of behavioral control over the water temperature, even though the control was only perceived, may have overridden the possible increase in stress due to the decisional control. The effectiveness of behavioral control was also studied by Corah and Boffa (1970). Unlike the present study, neither of these previous studies linked personal control to the reduction of pain.

The occurrence of reduced pain ratings in the presence of a stress reducer (perceived control) when compared to the group given the no-pain-reduction technique is consistent with Loeser's (1989) model of pain perception. In this model stress plays a role in the suffering of an individual (i.e., the evaluative component of pain). The present experiment was designed to evaluate a plausible link between stress and pain perception by comparing a stress-reduction technique with a known pain reducer and a control condition. Although the results are consistent with the hypothesis of what should happen when stress is reduced, no specific measure of stress was taken. Presently, it may only be stated that personal control, previously demonstrated to be effective in stress reduction, was also effective in reducing reported pain. The mechanism responsible for this pain-reducing property could be examined more closely in further experimentation by repeating this experiment and adding a measurement of stress. If the results of the present experiment are replicated, the addition of measured stress reductions would provide a more solid groundwork for evaluating the specific role of stress in the pain experience and lend further support to the accuracy of Loeser's (1989) model of pain perception.

References