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Loving-kindness language exposure leads to changes in sensitivity to imagined pain

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ABSTRACT

To better understand the cultivation of positive intra- and interpersonal emotions, we examined an argument that some effects of contemplative training result from language processing. We presented participants with loving-kindness language used in kindness-meditation training studies and asked them to rate imagined pain. If loving-kindness language processing is responsible for some effects recently reported we expected this language could affect intra- and interpersonal sensitivity. Loving-kindness-language participants rated imagined other-pain significantly higher and imagined self-pain significantly lower than closely matched control participants. As a result of this interaction, the loving-kindness-language group showed no significant difference between self-pain and other-pain, whereas controls rated self-pain significantly higher than other-pain. These results suggest that exposure to loving-kindness-language in Loving-Kindness Meditation leads to changes in sensitivity to own and vicarious distress without explicit training. These findings underscore that meditation-like effects may be easily induced. Further research is needed to determine duration and degree of effect.

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Language; cognition; meditation; loving-kindness; pain

Introduction

A steadily growing body of literature is building the case that brief training in kindness-based meditation may increase positive intra- and interpersonal skills and behaviour. While Buddhist teachings have long taught that kindness-based meditation increases prosocial behaviour (Davidson & Harrington, 2002), research into this phenomenon is still in its infancy. Recent findings suggest that relatively short-term training in kindness-based meditation increases general compassion as evidenced in increased feelings of sympathy and compassion for others (Lutz, Brefczynski-Lewis, Johnstone, & Davidson, 2008), behavioral measures of prosociality (Condon, Desbordes, Miller, & DeSteno, 2013; Leiber, Klimecki, & Singer, 2011) as well as in decreased intensity of personal feelings of distress among self-critical individuals (Shahar et al., 2015). Empirical evidence is scarce and the mechanisms involved in short-term programs may be very different from those that develop among long-term meditation practitioners (Hofmann, Grossman, & Hinton, 2011). Such results are furthermore difficult to de-confound from the possible effects of increasing attention to and thoughts about concepts related to kindness – i.e. love and compassion toward others and oneself – on subsequent intra- and

interpersonal ratings and behaviour, particularly given the use of wait-list control groups or control groups that do not include exposure to closely matched language. To address these issues we developed a language processing paradigm to investigate whether sensitivity to one's own and others' distress may differ in a group exposed to interpersonal loving-kindness-based language, compared to a group exposed to similar interpersonal but non loving-kindness-based language.

Benevolence or compassion refers to a state in which one holds positive emotion in equal measure to oneself and all human-beings and was considered by Aristotle (Ross & Brown, 2009) as an essential component of a life well lived. Buddhist training in benevolence, specifically through practices like Loving-Kindness Meditation, generally requires years of discipline, though recent experimental programs have shown changes following weeks or even minutes of training. Experimental programs to cultivate benevolence are based around these centuries old contemplative practices in which individuals focus on positive feelings in response to personal and vicarious suffering (Salzberg, 2002). Recent interest in the experimental manipulation of feelings related to the easement of personal and vicarious suffering and the promotion of

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prosocial behaviour have deep roots in ancient contemplative practice, for while meditation training programs are largely cognitive in nature, ancient Buddhist practices of benevolence training through meditation are inextricably linked to the cultivation of wisdom and the cessation of suffering (Bajracharya & Bajracharya, 2009).

Some of the earliest studies of kindness-based meditation provide evidence of increased self-reported support for others and increased implicit positive evaluations of others following brief loving-kindness meditation training (Fredrickson, Cohn, Coffey, Pek, & Finkel, 2008; Hutcherson, Seppala, & Gross, 2008). More recently, loving-kindness based training has been associated with decreased negative affect in response to videos depicting others in distress – videos that previously elicited increased negative affect following a similar program to train empathy (but not compassion) in the same participants (Klimecki, Leiberg, Ricard, & Singer, 2013). The authors of this study suggest that training increases the ability to cope with distress not by suppression of negative emotions in response to suffering but by the generation and strengthening of positive affect. Experimental Loving-Kindness Meditation training has further been associated with increased prosocial behaviour, in both laboratory-based and in real world settings (Condon et al., 2013; Leiberg et al., 2011). This recent body of research holds promise for the development of programs to cultivate feelings of kindness – and in line with the tradition of kindness-based meditation – benevolence and compassion toward self and others. However, it is possible that some portion of change in intra- and interpersonal sensitivity attributed to kindness-based training is due to increased attention to and thoughts about oneself and other people or to increased processing of concepts related to benevolence brought about by exposure to specific language.

Previous research has shown that social cognition may be implicitly affected by the induction of context salient emotions. For example, out-group biases may be increased by the induction of anger (DeSteno, Dasgupta, Bartlett, & Caidric, 2004) and the induction of disgust increases bias against disgust-relevant groups (Dasgupta, DeSteno, Williams, & Hunsinger, 2009). While these studies have looked at the effect of negative emotion induction on intergroup biases, a more recent study (Lai, Haidt, & Nosek, 2014) provides evidence that moral elevation – the theoretical opposite of disgust – can reduce prejudice against disgust-relevant groups. Studies to date have looked at the effect of emotion induction on intergroup cognition; however, if emotions function to increase adaptive responding to relevant environmental stimuli (Damasio, 2010; Keltner & Gross, 1999; LeDoux, 1996), it is reasonable to expect that paying attention to language like that used in Loving-Kindness Meditation based

training, will be associated with increased sensitivity to the pain of others or to protection against personal distress.

To what extent does the language alone change the way participants respond to others with compassion. In meditation training studies directed at increasing compassion (e.g. Leiberg et al., 2011) participants are given instruction and practice (i.e. training) in compassion meditation which includes repeating specific phrases to oneself, sitting quietly, increasing mental focus, and developing positive feelings. Meditation is not just the repetition of specific phrases but also targeted intentional control of aspects of thoughts, feelings and body movements. To investigate the role of language, the goal was to isolate the language from all other aspects of the compassion training provided in previous research by simply presented a spoken recording of a compassionate message one time, accompanied by the printed text of the message. By using novice participants, those with no prior meditation or compassion training, and with no other instructions than to understand the presented language, it is possible to isolate language from all other aspects of training used in previous research.

The present study investigated how exposure to loving-kindness-based language affects the perception of personal and vicarious distress, using a well-validated task previously linked to interpersonal sensitivity (Jackson, Brunet, Meltzoff, & Decety, 2006). If previous findings that kindness-based meditation training leads to increased intra- and interpersonal sensitivity by the practices surrounding meditation – the repetitive contemplation of personal and vicarious feelings in a state of quiet concentration – simple exposure to the language used in these practices, without the practice itself, should have no effect on intra- or interpersonal sensitivity. However, if listening to and understanding loving-kindness-based language alone is responsible in part for the results of previous training experiments, exposure to such language could produce similar effects. The loving-kindness-based language used was based on the secular practice of Loving-Kindness Meditation in which attention is focused on thoughts of love and compassion for oneself and others, though no instructions regarding meditation were presented to participants. The control group was exposed to a different set of sentences in which all words related to love and compassion were replaced with words related to health and security. We hypothesized that ratings of imagined pain for others would be significantly higher in the loving-kindness language condition compared to control condition. Consistent with previous studies, we further hypothesized that participants within the control condition would rate self pain significantly higher than other pain. However, given that the question of the present study focuses on

the effect of specific loving-kindness compassion language, we do not have a specific hypothesis regarding the size of the difference between rated self and other pain in comparison to those previous studies. Thus the prediction is the control condition should replicate previous studies without language priming, but the hypothesis that is specifically being tested is whether the experimental language condition produces a reversal of this effect, with pain ratings for others higher than for self pain.

Materials and methods

Participants

Forty-four healthy individuals from the University of Chicago and community participated in this study. The sample of participants included all who agreed to participate over the course of two academic quarters, and were randomly assigned to conditions. Participants had no prior meditation experience. After screening for outliers on pain ratings (pain ratings that were 2.5 standard deviations above or below the mean) 40 participants (20 females; 21 control participants) were included in final analyses. All participants gave written consent to participate in the study, which was approved by the University of Chicago Internal Review Board.

Stimuli

Language scripts were adapted from a Loving-Kindness Meditation script (Salzberg, 2002). The loving-kindness-based language script consisted of a series of statements such as: *May you be truly happy and deeply peaceful; May you live your life with ease; May you love yourself completely, just the way you are*, which focus on cultivating love and positive feelings for oneself, a close loved-one, a neutral stranger, and a difficult person successively expanding the distance from the participant to a difficult stranger. The control condition used a similar series of statements: *May you be truly well and free of illness; May you live your life in safety; May you take care of yourself completely, just the way you are*, in which all words related to love and compassion were replaced with words related to health and security. Scripts included language focused on attending to thoughts and parts of the body, and participants were asked to pay attention to and follow along with the script (See supplemental material for the full text of each condition). The speech was recorded by a female speaker, who is experienced in producing speech for laboratory use. The speech recordings were digitized, amplitude matched through software, and played to participants over headphones at a conversational level (about 75 dB SPL) under computer control.

Target stimuli for pain rating consisted of 120 digital photographs of hands or feet in four categories of pain: none, low, medium, and high, used in previous interpersonal sensitivity research (i.e. empathy-for-pain; Cheng, Chen, Lin, Chou, & Decety, 2010; Jackson et al., 2006; Jackson, Meltzoff, & Decety, 2005). Stimuli were randomly presented across six blocks, three using a *self*-perspective and three using an *other*-perspective. Picture duration lasted three seconds during which the participant could click anywhere on a visual analog scale (VAS), which was anchored between 'no pain' and 'worst possible pain' ranging from zero to 100, though numeric values were not visible to the participant. Before the first and between each subsequent block participants were shown a black screen with the word 'SELF' or 'OTHER'. The corresponding perspective was displayed at the top of each stimuli presentation.

Experimental procedure

All participants signed an informed consent agreement prior to participating in the study. Following exposure to the spoken language script for loving-kindness or security, participants performed the pain-rating task, and were then debriefed and received payment or course credit for participation. Experimental instructions, language scripts, and photo ratings were administered by software written with Psychtoolbox (Brainard, 1997) in Matlab. Participants read instructions on the use of the VAS and then rated several practice trials. The practice trials were followed immediately by the language script, in which participants heard a recording through high-definition quality headphones while simultaneously reading the text of the stimuli on a computer monitor. The pain-rating task immediately followed listening to the loving-kindness script or security script.

During the pain-rating task, participants saw images of hands and feet in varying degrees of pain and were instructed to rate this pain from a *self* or *other* perspective, in randomly alternating blocks of 20 stimuli. The batch of 120 images was composed of 30 each: no-pain, low, medium, and high pain stimuli. No-pain, low, medium, and high pain images were interspersed randomly throughout blocks, such that each set of four stimuli presented one image from each category. This pain rating procedure has been used extensively in a number of other studies (e.g. Decety, Skelly, & Kiehl, 2013; Jackson et al., 2005, 2006) of empathy.

Data analysis

Pain intensity ratings and reaction times (RTs) were scaled on an individual participant level across no-pain, low,

medium, and high pain conditions. One between-participant factor – language type (loving-kindness script vs. security script) – and two within-participant factors – depicted pain level (low, medium, and high) and perspective (self or other) – were included in a repeated measures analysis of variance (ANOVA), with follow-up *t*-tests for planned comparisons.

Results

In a repeated measures ANOVA with pain ratings as a dependent variable, with pain level and perspective as within subject factors and language type as a between subjects factor, the main effect of pain level was significant (Wilks' $\lambda = 0.22$, $F(2,37) = 66.24$, $p < 0.001$, $\eta_p^2 = 0.78$) as was the main effect of perspective (Wilks' $\lambda = 0.13$, $F(1,38) = 245.85$, $p < 0.001$, $\eta_p^2 = 0.87$). There was additionally a significant two-way interaction between pain level and language type (Wilks' $\lambda = 0.85$, $F(2,37) = 3.16$, $p = 0.05$, $\eta_p^2 = 0.15$), as well as between perspective and pain level (Wilks' $\lambda = 0.52$, $F(2,37) = 17.17$, $p < 0.001$, $\eta_p^2 = 0.48$). The repeated measures ANOVA was followed by two planned comparisons (Figure 1): one looking at the difference in perspective between self and other, within each language condition, and one looking at differences within perspectives between types of language.

A *t*-test looking at differences in pain sensitivity between self and other perspective, at each pain level, indicated that there were no significant differences in pain sensitivity for self or other perspectives at low or medium pain levels. For the high pain condition, there was a significant interaction between type of language and perspective

(Wilks' $\lambda = 0.80$, $F(1,38) = 9.76$, $p < 0.01$, $\eta_p^2 = 0.20$), such that loving-kindness-language participants displayed significantly higher imagined pain for others (*loving-kindness other* mean = 0.80, SD = 0.16; *security other* mean = 0.70, SD = 0.11; $t(38) = 2.07$, $p < 0.05$, two-tailed, 95% CI [0.015, 0.188], Cohen's $d = 0.75$), and significantly lower imagined pain for self, compared to control participants (*loving-kindness self* mean = 0.73, SD = 0.14; *security self* mean = 0.81, SD = 0.12; $t(38) = 2.39$, $p < 0.05$, two-tailed, 95% CI [-0.167, -0.002], Cohen's $d = 0.66$).

For the high pain condition, there was a significant difference in pain sensitivity between self and other perspective for the security language group such that self pain was rated higher than other-pain (*security self* mean = 0.81, SD = 0.12; *security other* mean = 0.70, SD = 0.11, $t(20) = 3.04$, $p < 0.01$, two-tailed, 95% CI [0.036, 0.194], Cohen's $d = 1.01$). The loving-kindness language produced a marginally significant difference in pain sensitivity between self and other (*loving-kindness self* mean = 0.73, SD = 0.14; *loving-kindness other* mean = 0.80, SD = 0.16, $t(20) = -1.52$, $p = 0.15$, two-tailed, 95% CI [-0.169, .027], Cohen's $d = 0.48$).

Discussion

As hypothesized, loving-kindness-language processing increased ratings of imagined pain for others, compared to security-language processing, though this occurred only for high pain stimuli. This is in line with previous research in which Loving-Kindness Meditation training leads to increased interpersonal sensitivity (Klimecki, Leiberg, Lamm, & Singer, 2013; Klimecki, Leiberg, Ricard et al., 2013), while calling into question whether some portion of previous findings, regarding the effects of positive emotion induction and training, are due to participants acting more beneficent due to implicit biases brought about by conceptual processing of the language used in the practice.

Also supporting our hypotheses, participants in the control condition, who read security-based language, rated self-pain higher than other-pain, and participants who read loving-kindness-based language did not show a significant difference between imagined pain for self and imagined pain for others. This attenuation in difference between self and other imagined pain was due in part to an increase ratings of pain for others, but also due to a decreased sensitivity to imagined pain for self. It is possible that by increasing positive emotions in response to distress, processing loving-kindness language increases personal protective resources. This would be in line with previous research findings which suggest that kindness-based meditation training leads to increased positive emotions without ignoring, suppressing, or otherwise changing negative environmental realities (Fredrickson et al., 2008; Klimecki, Leiberg, Ricard et al., 2013).

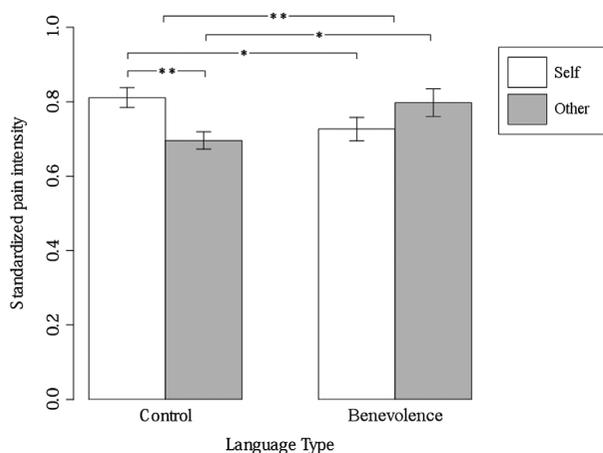


Figure 1. Mean ratings of imagined pain for high pain condition. Notes: Perspective interacted with language ($p < 0.01$), whereby control participants rated self-pain significantly higher than other-pain ($p < 0.01$) and loving-kindness language participants rated self-pain lower than other pain, though this difference was not significant ($p = 0.14$). Loving-kindness language participants rated other pain significantly higher ($p < 0.05$) and self-pain significantly lower ($p < 0.05$) than control language participants. Error bars represent 95% confidence intervals.

While previous studies have shown a relationship between kindness-based meditation training and increased positive intra- and interpersonal thoughts and behaviour, this is the first we are aware of to show that increased intra- and interpersonal sensitivity may be induced without any explicit contemplative training. Future research is needed to determine whether increased vicarious and decreased personal sensitivity to imagined pain manifests in changes to actual pain sensitivity, as well as to investigate possible routes through which exposure to and processing of loving-kindness language may lead to long term changes in intra- and interpersonal sensitivity and prosocial behaviour.

Author contributions

P. B. Williams, H. C. Nusbaum, and J. Decety contributed to the study concept. All authors contributed to the study design. P. B. Williams and G. Poljacik conducted analyses under the supervision of H. C. Nusbaum. P. B. Williams and G. Poljacik drafted the manuscript, while H. C. Nusbaum and J. Decety provided critical review. All authors approved of the final revision of the manuscript for submission.

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No potential conflict of interest was reported by the authors.

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