

MODIFYING PAIN PERCEPTION: IS IT BETTER TO BE HYPNOTIZABLE OR FEEL THAT YOU ARE HYPNOTIZED?

Nicholas Hylands-White, Stuart WG Derbyshire

School of Psychology, University of Birmingham, Birmingham, UK

Abstract

Two studies investigated the effect of hypnotic susceptibility (study 1) and the label 'hypnosis' (study 2) on the perception of a noxious stimulus (cold pressor). Suggestions for pain control during hypnosis are highly effective but the mechanisms of this effect and the role of the hypnotic induction in achieving pain relief remain uncertain. Study 1 demonstrated increasing pain experience with hypnotic susceptibility during performance of a visual distraction task, i.e. greater hypnotic susceptibility resulted in greater pain experience when performing the task. There was no relationship between pain experience and hypnotic susceptibility when not performing the task. Study 2 demonstrated that the use of the label 'hypnosis' to describe a relaxation recording increased feelings of being hypnotized and decreased pain experience relative to the same recording being labelled 'relaxation' outside of task involvement. In conclusion, hypnotizability per se does not facilitate a reduction in pain experience whereas the label 'hypnosis' does reduce pain experience. It is possible that the use of hypnotic terminology in the context of pain provides a reduction in pain experience through mechanisms that are not automatically engaged by those who are highly hypnotizable. Copyright © 2007 British Society of Experimental & Clinical Hypnosis. Published by John Wiley & Sons, Ltd.

Key words: attention, suggestion, induction, expectancy, labelling

Introduction

Information processing models of attention describe attention as a cognitive processor of limited capacity with access controlled by filters and/or a supervisory system (Broadbent, 1958; Schiffman, 1988; Norman and Schallice, 1986). Regularly performed tasks become automatic and require little attentional capacity. Novel or threatening stimuli, in contrast, require a large amount of attentional capacity and have the potential to interrupt ongoing tasks (Eccleston and Crombez, 1999). Consequently, pain tends to switch attention from current focal tasks towards escape from the noxious stimulus. As the threat subsides attention switches between the previous focal task and the ongoing pain. Pain can be ignored when there is sufficient attentional capacity to focus on the task to the exclusion of pain.

The ability to focus attention on a task while ignoring other stimuli is related to hypnotic susceptibility. The ability to focus attention on the hypnotist's voice and ignore irrelevant stimuli is required to complete the first stage of hypnosis as described by the

neuropsychophysiological model of hypnotic induction (Crawford and Gruzelier, 1992; Crawford, 1994; Gruzelier, 1998; 2006). Highly hypnotizable subjects should, therefore, show a greater performance of attentional functioning both in and out of hypnosis. This proposal has received some empirical support. The Stroop interference effect, for example, is significantly reduced in highly hypnotizable (HH) compared to low hypnotizable (LH) participants (Rubichi, Ricci, Padovani and Scaglietti, 2005). Performance is also significantly better amongst HH compared to LH participants on tasks of sustained and focused attention that require environmental distractions, such as the Necker cube illusion and the autokinetic movement illusion, to be ignored (Crawford, Brown and Moon, 1993).

If HH participants are better at focusing attention they should be better able to reduce pain using distraction even when not hypnotized (Hilgard and Hilgard, 1994). Studies relating hypnotic susceptibility and pain, however, indicate mixed results. Miller, Barabasz and Barabasz (1991) reported no significant differences between HH and LH participants experiencing cold pressor pain when not hypnotized. Following hypnotic induction, however, the HH participants' pain scores were significantly lower than the LH participants. In contrast, Farthing, Venturino, Brown and Lazar (1997) demonstrated significant pain reduction for HH participants during distraction compared to no distraction when not hypnotized, while LH participants did not report reduced pain levels. Horton, Crawford, Harrington and Downs (2004) also observed that HH participants exhibited more effective attentional and inhibitory capabilities, including in some cases demonstrated inhibitory control of pain.

It is possible that HH participants sometimes report less pain during distraction because of expectancy associated with being a highly hypnotizable participant. Gandhi and Oakley (2005) demonstrated greater responsiveness to suggestion after listening to a relaxation script labelled as 'hypnosis' compared to the identical script labelled as 'relaxation'. It is suggested that the use of the label 'hypnosis' trigger lay beliefs, expectations and motivations concerning hypnosis that subsequently modify behaviour and experience. Earlier studies by Barber and Calverly (1964; 1965) also enhanced suggestibility after labelling a situation as hypnosis even though the participants never received a hypnotic induction. Furthermore there is evidence to suggest that non-hypnotic procedures labelled as hypnosis may produce levels of hypnotic responsiveness equivalent to those produced by hypnotic induction while some identical psychodynamic and cognitive behavioural treatments are improved by just adding the word 'hypnosis' (Council, Kirsch, Vickery and Carlson, 1983; Baker and Kirsch, 1993; Kirsch, 1996; Lynn, Vanderhoff, Shindler and Stafford, 2002).

In the first study we assessed the effect of being highly hypnotizable on pain distraction in participants unaware of their hypnotizability. In a second study we assessed the reduction in pain experience brought about by labelling an identical relaxation script as 'hypnosis' or 'relaxation'.

Method

Participants

Participants were all volunteers drawn from the student population of the University of Birmingham and received course credit for their participation. All participants provided written informed consent. Study 1 included 24 right handed participants (10 male; mean age 21, range 18–28). Study 2 included 37 right handed participants (8 male; mean age 20.5, range 18–36).

Procedure: Study 1

Hypnotic susceptibility was assessed using the Harvard Group Scale of Hypnotic Susceptibility: Form A (Shor and Orne, 1962) using a pre-recorded CD and portable stereo. Participants were assessed in groups of 2–12. Participants completed the self-report measures but the Harvard score was not calculated by the experimenter until all participants had completed the task. Thus the experimenters remained blind to the hypnotizability of the participants and did not communicate any scores to the participants or suggest any importance relative to subsequent procedures.

Between 4 and 12 days later, participants were tested individually to assess their pain experience during cold pressor pain with and without distraction induced by observing the Necker cube illusion (see Figure 1). Participants were provided with standardized instructions and familiarized with the Necker illusion before further testing began. The session then proceeded in three sections that were counterbalanced to minimize the effects of fatigue, boredom or sensitization. A resting period of 10 minutes separated each of the sections.

Cold pressor with the Necker cube illusion

Participants observed a vertical 5 × 5 cm (line weight 8pt) Necker cube on a white A4 piece of paper from a comfortable distance of approximately 75 cm. Due to the lack of available depth cues, the Necker cube can appear in two different orientations and will be seen to periodically ‘flip’ between these alternative orientations. Participants were asked to report each of these flips by saying ‘now’ once their right hand entered the cold pressor (Crawford et al., 1993).

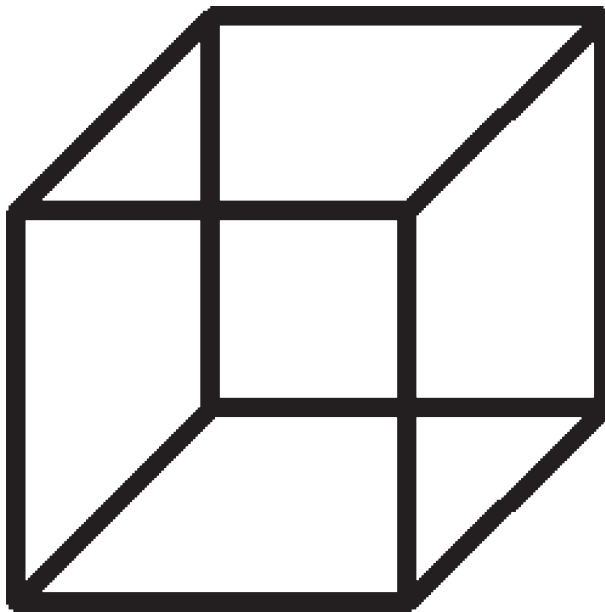


Figure 1. The Necker cube illusion. The lack of available depth cues means that the Necker cube can appear in two different orientations and will periodically ‘flip’ between these alternative orientations.

The cold pressor consisted of a 10-litre bucket half filled with ice and topped up with cold tap water. The water temperature was maintained at 4°C ($\pm 1^\circ\text{C}$) according to standard procedures (Hilgard, 1975; Walsh, Schoenfeld, Ramamurthy and Hoffman, 1989).

Pain reports were recorded after 30 seconds and 4 minutes of immersion using the sensory and affective pain scales devised by Gracely, McGrath and Dubner (1978). Pain intensity was rated on a 21-point ratio scale where 0 was no sensation and 20 was maximum intensity. Pain unpleasantness was also rated on a 21-point scale where 0 was neutral and 20 was maximum unpleasantness. The participants were asked to indicate their levels of pain intensity and unpleasantness by verbal report. Gracely et al. (1978) report excellent reliability with a correlation across experiments of $r = 0.99$ for both scales. After the second pain report, participants removed their hand from the cold pressor and were provided with towels to dry their hand.

Cold pressor only

Participants placed their hand into the cold pressor for four minutes and pain reports were recorded after 30 seconds and 4 minutes and then participants removed and dried their hand as described previously.

Necker cube illusion only

Participants were presented with the Necker cube for 4 minutes and asked to report perspective changes as described previously.

Procedure: Study 2

Participants were randomly divided into 'relaxation' or 'hypnosis' groups and experienced the cold pressor stimulus, as described previously, before and after listening to a recording labelled 'relaxation' or 'hypnosis'. The order of these conditions was counter-balanced such that half the participants experienced the first cold pressor immediately after hearing the recording (recording first) and half the participants experienced the first cold pressor before hearing the recording (recording second). A resting period of 10 minutes separated the two cold pressor trials.

Participants in the relaxation group were read the following standardized instructions prior to hearing the recording:

'In this part of the study, we want to assess your experience of the cold pressor whilst being relaxed. So in this version, the cold pressor will be preceded by relaxation instructions to help you become relaxed.'

Participants in the hypnosis group were read a modified set of instructions:

'In this part of the study, we want to assess your experience of the cold pressor whilst in hypnosis. So in this version, the cold pressor will be preceded by a hypnotic induction to help you become hypnotized.'

Participants were then played an identical pre-recorded relaxation script using a portable stereo player. After the recording was finished, participants immersed their right hand in the cold pressor, as for study 1, for 5 minutes. Pain reports were recorded using the Gracely scales, as for study 1, after 30 seconds, 1 minute and then at minute intervals until the end of the 5-minute period. Following the end of the procedure participants in the relaxation group were brought out of relaxation with an instruction to open their eyes

and those in the hypnosis group were brought out of their ‘hypnosis’ with a standard script. All participants then withdrew their hand from the cold pressor and dried it with towels.

For the cold pressor alone condition, participants immersed their hand in the cold water for 5 minutes and the experimenter took pain reports after 30 seconds, 1 minute and then at minute intervals until the end of the 5-minute period.

After completion of both cold pressor trials, participants completed a short questionnaire using a series of 10-point rating scales (0 = not at all, to 10 = completely) to rate how well they felt the ‘hypnosis’ or ‘relaxation’ helped them to ignore the pain; how relaxed they felt following the recording; and how hypnotized they felt following the recording. Participants were also invited to write down what strategies, if any, they had used to help ignore the pain.

Results: Study 1

The average Harvard objective score for the participants in study 1 was 5.2 (range 1–9). Figure 2 plots the regression of pain unpleasantness rated using the Gracely scales versus Harvard score at 4 minutes (no effects were observed at 30 seconds). No relationship between rating and Harvard was apparent when participants experienced the cold pressor without the Necker cube illusion ($R^2 = 0$). When participants observed the Necker cube illusion, however, a positive relationship between rating and hypnotizability was apparent ($R^2 = 0.19$, $p < 0.05$).

The intensity ratings provided similar findings with no observable relationship between ratings and hypnotic susceptibility at 30 seconds. At 4 minutes, intensity ratings increased with hypnotic susceptibility only when participants observed the Necker cube but these effects did not reach significance (observing the Necker cube illusion, $R^2 = 0.1$, $p = 0.13$; without, $R^2 = 0$).

A paired t-test revealed that the number of Necker reversals reported by participants were not different in the presence or absence of the cold pressor (mean reversals with

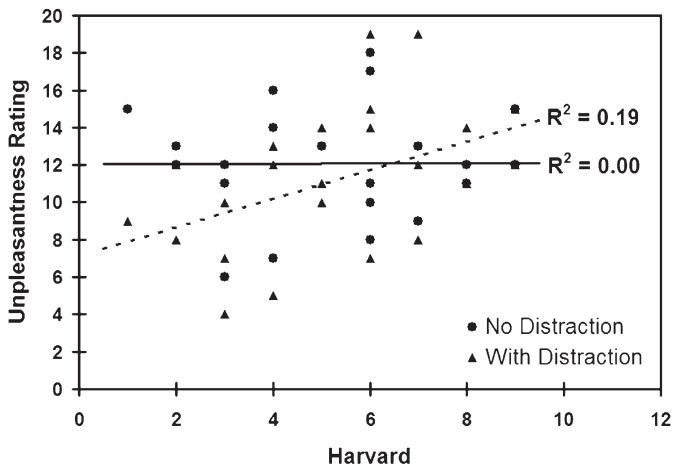


Figure 2. Pain unpleasantness ratings plotted against the Harvard objective score with distraction (dashed line, triangles show individual participants) and without distraction (solid line, circles).

cold pressor = 44.5, without = 43.8: $t_{23} = 0.2$, $p = 0.8$). Observation of the Necker cube, however, did reduce pain ratings. A factorial ANCOVA with time and condition as the factors and the Harvard subjective score as a covariate revealed a significant main effect of condition on pain unpleasantness ($F_{1,22} = 12.9$, $p < 0.05$), with participants experiencing greater pain unpleasantness when not observing the Necker cube. Participants also reported greater pain intensity when not observing the Necker cube ($F_{1,22} = 7.6$, $p < 0.05$). Table 1 shows the average pain ratings during each condition, illustrating the higher ratings when not observing the Necker cube. Post-hoc t-tests revealed only the intensity ratings at 30 s to be independently significant ($t_{23} = 2.6$, $p < 0.01$).

Results: Study 2

Figure 3 illustrates the difference (Δ) in intensity rating (averaged across the 6 rating periods) of the cold pressor when contrasting the cold pressor before hearing the recording with the pressor after hearing the recording. For both 'relaxation' and 'hypnosis'

Table 1. The means and standard deviations (SD) for the ratings reported with and without distraction (observing the Necker cube illusion)

Measure	With Distraction (SD)	Without Distraction (SD)
Intensity (30 s)	12.0 (3.5)	13.3 (2.8)
Intensity (4 min)	12.7 (3.5)	13.5 (3.0)
Unpleasantness (30 s)	10.4 (3.8)	11.3 (4.0)
Unpleasantness (4 min)	11.2 (3.9)	12.1 (3.0)

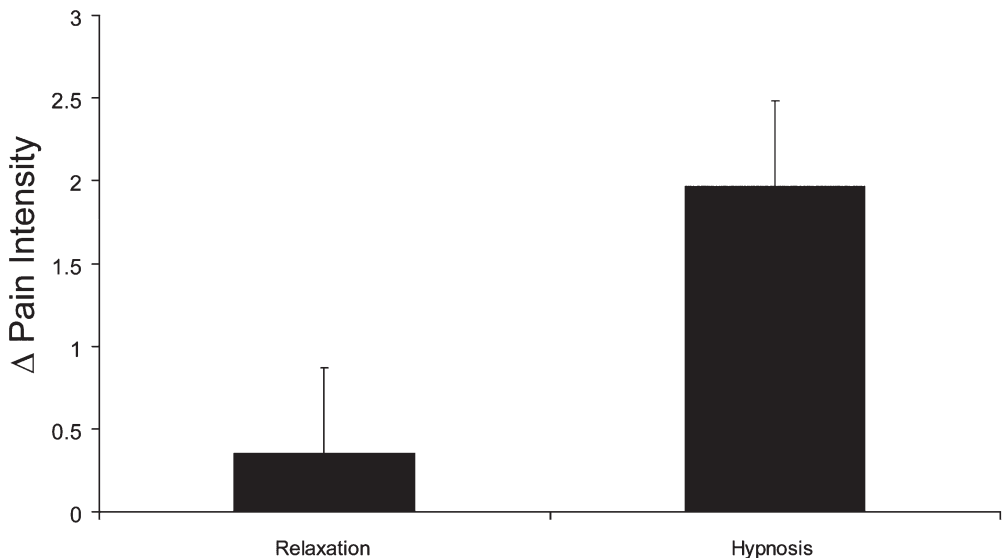


Figure 3. An illustration of the difference (Δ) in intensity rating of the cold pressor when contrasting the period before hearing the recording with the period after hearing the recording according to whether the recording was labelled 'relaxation' or 'hypnosis'.

Note: The error bars show standard deviations.

there was a reduction in pain ratings after hearing the recording but that difference was significantly larger after the recording labelled as ‘hypnosis’. The data were analyzed using a factorial ANOVA with label, order of recording and time of rating as the factors. Label was revealed as a significant main effect ($F_{1,36} = 4.9, p < 0.05$).

Figure 4 illustrates the difference (Δ) in unpleasantness rating of the cold pressor when contrasting the period before hearing the recording with the period after hearing the recording. Only ‘hypnosis’ provided a reduction in pain ratings after hearing the recording. The data were analyzed using a factorial ANOVA with the same factors as before. Label was revealed as a significant main effect ($F_{1,36} = 5.8, p < 0.05$).

Figure 5 illustrates the post-hoc ratings provided by the participants in each group. Participants in the ‘hypnosis’ and ‘relaxation’ groups reported similar feelings of relaxation and ability to ignore the pain after hearing the recording. The ‘hypnosis’ group, however, reported feeling significantly more hypnotized ($F_{1,36} = 26, p < 0.05$).

Discussion

Study 1 assessed the relationship between pain reduction during performance of a distraction task and hypnotizability. Based on the theory that HH participants have a more efficient attentional system (Gruzelier, 1998) and are able to inhibit unwanted stimuli from reaching perceptual awareness (Hilgard and Hilgard, 1994) it was expected that hypnotizability would reduce pain during distraction. This expectation was not supported and, at least for the unpleasant component of pain, pain experience actually increased with hypnotizability during distraction.

Study 2 assessed whether labelling a procedure as ‘hypnosis’ would subsequently reduce pain experience relative to labelling the exact same procedure as ‘relaxation’. This expectation was supported and provides further evidence that at least some of the

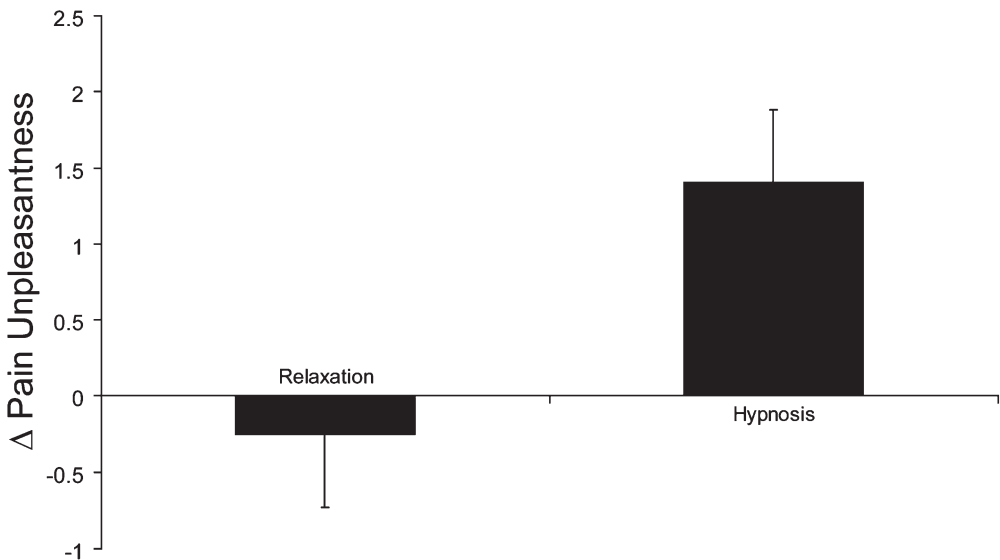


Figure 4. An illustration of the difference (Δ) in affective rating of the cold pressor when contrasting the period before hearing the recording with the period after hearing the recording according to whether the recording was labelled ‘relaxation’ or ‘hypnosis’.

Note: The error bars show standard deviations

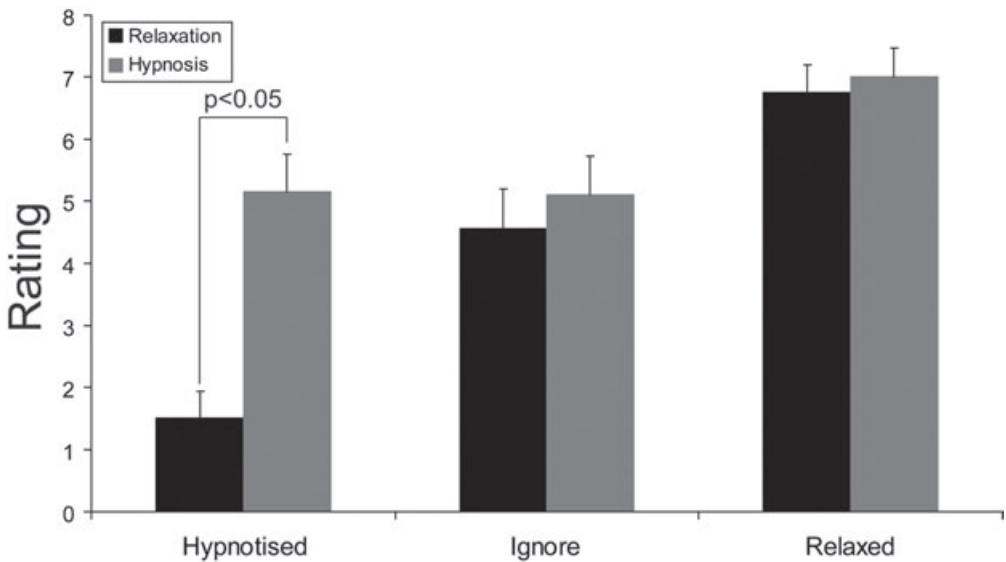


Figure 5. An illustration of the post-hoc ratings provided by the participants in the ‘hypnosis’ group (grey bars) or ‘relaxation’ group (black bars).
Note: The ‘hypnosis’ group reported being significantly more hypnotized but there were no significant differences reported in how much the script helped the participants to ignore the pain or how relaxed it made them feel.

experiences attributed to a hypnotic induction are the result of lay expectations and beliefs that are triggered by the label ‘hypnosis’ (Kirsch 1996; Gandhi and Oakley, 2005). Examined together, these two studies suggest that being highly hypnotizable does not in itself lead to the recruitment of attentional mechanisms to reduce pain although a hypnotic context does provide pain relief. In order to reduce pain experience, therefore, it is better that the participant believes they could be hypnotized rather than being highly hypnotizable.

Being highly hypnotizable could be detrimental to pain relief via distraction if the efficiency of the frontal executive system in the HH participants allows them to focus on the task and the pain simultaneously. In the model of the interruption of attention by pain, pain takes precedence over the task only until there is sufficient capacity to focus on the task (Eccleston and Crombez, 1999); the pain still receives a portion of the attentional capacity. In study 1, the participants appeared to be engaged in the task equally well in both conditions as demonstrated by the similar numbers of Necker reversals in both conditions, indicating that the pain did not affect their ability to perform the task.

Earlier studies that have demonstrated an effect of hypnotizability on task performance have required participants to ignore non-noxious environmental stimuli e.g. words in the Stroop task (Rubichi et al., 2004), non-task related visual and auditory stimuli (Crawford et al., 1993), or to perform non-noxious distraction tasks e.g. mental arithmetic (Wallace and Priebe, 1985; Wallace, 1986). In contrast to non-noxious stimuli, pain is an environmental distractor that may be more difficult to ignore.

Our findings do not support those reported by Farthing, Venturino, Brown and Lazar (1997), who used a design similar to that of study 1. Important differences between the two studies, however, could account for the discrepant findings. Farthing et al. (1997) collected pain ratings without distraction over a one minute period, followed by a four

minute period of cold pressor with distraction. Consequently their comparison of pain ratings in and out of distraction was confounded by time effects. Walsh et al. (1989) reported peak cold pressor pain 60–90 seconds after the start of the procedure and we observed our early pain ratings to be greater than the later ratings. If the first minute of immersion in the cold pressor is the most painful then comparing ratings at four minutes to those recorded at one minute is likely to provide a reduction in pain regardless of any additional conditions that are introduced. By counterbalancing our procedures we are able to avoid this criticism.

Study 2 demonstrates that pain relief can be obtained by labelling an identical delivered script as ‘hypnosis’ rather than ‘relaxation’. This finding suggests that the label ‘hypnosis’ triggers lay beliefs and expectations of pain relief that mobilize effective cognitive, or other mechanisms, to reduce pain regardless of actual hypnotizability. This suggestion is supported by the fact that participants in both the ‘hypnosis’ and ‘relaxation’ group reported similar feelings of relaxation and benefit but the participants who heard the script described as ‘hypnosis’ reported feeling significantly more hypnotized. Presumably, the lay beliefs and expectations of pain relief from hypnosis are not automatically engaged by those who are highly hypnotizable when they are not prompted to consider the environment to be ‘hypnotic’.

It is possible that informing the participants in study 1 of their hypnotic status and the possible relation with distraction would produce a reduction of pain experience in the HH participants during distraction. In the absence of any expectancy of pain relief due to hypnosis, indeed in the absence of any specific knowledge about their hypnotizability, the participants did not benefit from being highly hypnotizable and even suffered more pain unpleasantness. Importantly, participants did derive an overall benefit from the distraction procedure; observing the Necker cube and reporting flips significantly reduced pain experience. Thus the effect of distraction remained but was diminished in the participants with increasing hypnotic susceptibility.

Although the possibility that pain reduction due to hypnotizability was not observed in study 1 because of the lack of a hypnotic context has some purchase (it was induced in study 2 by using the word ‘hypnosis’), further studies will be necessary to directly address the possibility. An obvious future study could engage further groups in cold pressor and distraction and inform some groups of their hypnotic status prior to the distraction. Additional manipulations might include mis-informing some groups (such as suggesting the participants to be HH when they are actually LH and vice versa) and suggesting alternative interactions with the distraction (suggesting that the distraction will be beneficial or detrimental).

One problem common to all studies assessing pain with subjective report is that participants are required to temporarily stop focussing on whatever task they may be carrying out in order to report their pain. This requires them, albeit briefly, to focus attention on their pain, which immediately undermines the distraction. An alternative method is to measure tolerance to pain, such as how long a participant can sustain the cold pressor before they are compelled to withdraw. This method is difficult because it is quite easy to create response bias by alluding to the analgesic properties of the distraction task (Eccleston, 1995). This is similar to the effects described with the label ‘hypnosis’ and there may be opportunities to investigate how the triggering of different expectations and lay beliefs can interact.

In summary, our two studies demonstrate that there is no inherent analgesic benefit due to distraction during cold pressor with increasing hypnotizability. We do report, however, a significant analgesic benefit from labelling a procedure as ‘hypnotic’ rather

than 'relaxation'. When experiencing cold pressor pain, therefore, it might be preferable to believe that you are hypnotized rather than actually being highly hypnotizable.

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References

- Baker SL, Kirsch I (1993) Hypnotic and placebo analgesia: order effects and the placebo label. *Contemporary Hypnosis* 10: 117–26.
- Barber TX, Calverley DS (1964) Empirical evidence for a theory of hypnotic behaviour: effects on suggestibility of five variables typically included in hypnotic induction procedures. *Journal of Consulting Psychology* 29: 98–107.
- Barber TX, Calverley DS (1965) Toward a theory of hypnotic behaviour: effects on suggestibility of defining the situation as hypnosis and defining response to suggestions as easy. *Journal of Abnormal and Social Psychology* 68: 585–92.
- Broadbent DE (1958) *Perception and communication*. Oxford UK: Pergamon Press.
- Council JR, Kirsch I, Vickery AR, Carlson D (1983) 'Trance' vs. 'skill' hypnotic inductions: the effect of credibility, expectancy and experimenter modelling. *Journal of Consulting and Clinical Psychology* 51: 432–40.
- Crawford HJ, Gruzelier J (1992) A midstream view of the neuropsychophysiology of hypnosis: recent research and future directions. In E Fromm and M Nash (eds) *Contemporary Perspectives in Hypnosis Research*. New York: Guilford Press, 227–66.
- Crawford HJ, Brown AM, Moon CE (1993) Sustained attentional and disattentional abilities: differences between low and highly hypnotizable persons. *Journal of Abnormal Psychology* 102: 534–43.
- Crawford HJ (1994) Brain dynamics and hypnosis: attentional and disattentional processes. *International Journal of Clinical and Experimental Hypnosis* 42: 204–32.
- Eccleston C (1995) The attentional control of pain: methodological and theoretical concerns. *Pain* 63: 3–10.
- Eccleston C, Crombez G (1999) Pain demands attention: a cognitive–affective model of the interruptive function of pain. *Psychological Bulletin* 125: 356–66.
- Farthing GW, Venturino M, Brown SW, Lazar JD (1997) Internal and external distraction in the control of cold-pressor pain as a function of hypnotizability. *International Journal for Clinical and Experimental Hypnosis* 45: 433–46.
- Gandhi B, Oakley DA (2005) Does 'hypnosis' by any other name smell as sweet? The efficacy of 'hypnotic' inductions depends on the label hypnosis. *Consciousness and Cognition* 14: 304–15.
- Gracely RH, McGrath F, Dubner R (1978) Ratio scales of sensory and affective verbal pain descriptors. *Pain* 5: 5–18.
- Gruzelier JH (1998) A working model of the neurophysiology of hypnosis: a review of evidence. *Contemporary Hypnosis* 15: 3–21.
- Gruzelier JH (2006) Frontal functions, connectivity and neural efficiency underpinning hypnosis and hypnotic susceptibility. *Contemporary Hypnosis* 23: 15–32.
- Hilgard ER, Hilgard JR (1994) *Hypnosis in the Relief of Pain*. UK: Psychology Press.
- Hilgard ER (1975) The alleviation of pain by hypnosis. *Pain* 1: 213–31.
- Horton JE, Crawford HJ, Harrington G, JH Downs III (2004) Increased anterior corpus callosum size associated positively with hypnotizability and the ability to control pain. *Brain* 127: 1741–7.
- Kirsch I (1996) Hypnosis in psychotherapy: efficacy and mechanisms. *Contemporary Hypnosis* 13: 109–14.

- Lynn SJ, Vanderhoff H, Shindler K, Stafford J (2002) Defining hypnosis as a trance vs. cooperation: hypnotic inductions, suggestibility and performance standards. *American Journal of Clinical Hypnosis* 44: 231–40.
- Miller FM, Barabasz AF, Barabasz M (1991) Effects of active alert and relaxation hypnotic inductions on cold pressor pain. *Journal of Abnormal Psychology* 100: 223–6.
- Norman DA, Schallice T (1986) Attention to action: willed and automatic control of behaviour. In: RJ Davidson, GE Schwartz, D Shapiro (eds) *Consciousness and Self-regulation: Advances in Research and Theory* (Vol. 4). London: Plenum Press, 1–18.
- Rubichi S, Ricci F, Padovani R, Scaglietti L (2005) Hypnotic susceptibility, baseline attentional functioning, and the Stroop task. *Consciousness and Cognition* 14: 296–303.
- Schiffman RM (1988) Attention. In: RC Atkinson, RS Herrnstein, G Lindzey and R Luce (eds) *Steven's Handbook of Experimental Psychology*, Vol. 2: Learning and Cognition (3rd edn). New York: Wiley, 739–811.
- Shor RE, Orne EC (1962) *Harvard Group Scale of Hypnotic Susceptibility: Form A*. Palo Alto, CA: Consulting Psychologists Press, Inc.
- Wallace B, Priebe FA (1985) Hypnotic susceptibility, inference, and alternation frequency to the necker cube illusion. *The Journal of General Psychology* 112(3): 271–277.
- Wallace B (1986) Latency and frequency reports to the necker cube illusion: Effects of hypnotic susceptibility on mental arithmetic. *The Journal of General Psychology* 113(2): 187–194.
- Walsh NE, Schoenfeld L, Ramamurthy S, Hoffman S (1989) Normative model for cold pressor test. *American Journal of Physical Medicine and Rehabilitation* 68: 6–11.

Address for correspondence:

Stuart WG Derbyshire

University of Birmingham

School of Psychology

Edgbaston

Birmingham B15 2TT

Tel: 0121 414 4659

Fax: 0121 414 4897

Email: s.w.derbyshire@bham.ac.uk