Social Effects of Causal Opacity and Pain in Rituals

Laura McCambridge

A thesis submitted for the degree of

Master of Science

at the University of Otago, Dunedin, New Zealand

March, 2015

Abstract

Rituals are known to bring groups of people together, but it is not clear what creates this bonding effect. Two prominent features of rituals are (1) they often involve pain or unpleasant experiences; and (2) they are often "causally opaque"; there is no shared understanding of the mechanism by which the ritualized behaviour exerts its effects. The current study represents the first experimental research examining how pain and causal opacity combine to produce group bonding. Participants engaged in a laboratory "ritual" that involved submersing their hands in cold (painful) water, or in tepid water. Causal opacity was manipulated independently, with half of the participants given an account of the functional reasons for performing the ritual, and half not. Afterwards, the group members' physical proximity to each other was measured, as well as group fusion, identification, and co-operation. The latter measures were also completed one week later.

Results revealed that group bonding depended on both causal opacity and pain. When the purpose of the task was transparent, participants sat closer together and were perceived to be more fused in the pain condition. When the purpose of the task was opaque, participants reported feeling more fused in the control condition than in the pain condition. These findings suggest that when they are in pain, people search for a reason why. This attribution becomes shared knowledge that contributes to group identity and fusion.

This has implications for real world situations in which pain is used as social glue (e.g., initiation rituals), suggesting that if participants believe they are suffering pointlessly, they may not experience group bonding effects.

Acknowledgments

Firstly I would like to thank my supervisor Professor Jamin Halberstadt for his guidance and wide-reaching knowledge, and for being available whenever I needed him, even from the other side of the world.

Secondly, I would like to thank my lab manager Joshua Jackson. I have no doubt that I would not have been able to finish this thesis without his direction. Thank you also to Jonathan Jong for his inspiration.

To my fellow 'struggling masters students'; thank you for always being available for lunch and a cry about our situation. To my parents Viv and Bardy McCambridge; I am so grateful to you for believing in me and for all of your encouragement.

Finally I would like to thank my amazing boyfriend Peter Rae who has been so supportive and patient while I complete this project. I can't wait for our Big Trip.

Table of Contents

List of Tables & Figures

Social Effects of Causal Opacity and Pain in Rituals

Humans have participated in rituals, cross-culturally, at least as long ago as the Upper Palaeolithic (Whitehouse, 2012). For example, there is forensic evidence dating back 7000 years of the practice of teeth removal of Aboriginal men and women (Byard & Simpson, 2005). This painful procedure occurs around the time of puberty to signify the passing on of the individual into manhood. Indeed, many rituals require great effort or endurance of pain. Why, then, do social groups develop them, and why do individuals engage in them? One well-accepted theory is that rituals influence the cohesiveness of groups (Ibn Khaldūn, 1958), but what is it about rituals that bring people in a group closer together? Here we consider the group bonding effects of both pain and causal opacity, and the outcome when these two aspects are combined.

Group cohesion

There are two types of group bonding that this study will focus on – group fusion and group identification. Group fusion is where the distinction between someone's personal identity and their group identity becomes blurred (Swann, Gómez, Seyle, Morales & Huici, 2009). Highly fused people develop strong relational ties to other members of their group. Relational ties result in people perceiving members of their in-group as a type of "family" rather than as an abstract group (Brewer & Gardner, 1996). The members are considered to be unique and therefore irreplaceable, just as one feels about members of their own biological family. Because the other members of the group are thought of as a type of extended family, there is then a feeling of functional equivalence – all of the group members are important in their own unique way (Gómez et al., 2011). Such strong ties promote a sense of obligation to help and defend other group members, to do anything to protect their group. This feeling may be projected onto other group

members so there is a conviction that the other group members will act in the same way, thus protecting the group and creating a feeling of reciprocal strength. This creates feelings of invulnerability within the group, as the group is perceived as being powerful.

In contrast, one's group identity refers to the groups of which someone feels they are a part, such as 'New Zealander' or 'student'. Groups that identify with each other (as opposed to groups where the members are fused) are referred to as an imagined community (Anderson, 1983). Group members here form 'collective ties' with members of their imagined community (Brewer & Gardner, 1996). These ties are based on the group members' perceptions of overlap between their own characteristics and the typical characteristics of their in-group. Members of collective groups do not consider their group members to be unique, and thus they tend to be thought of as replaceable (Tajfel & Turner, 1979). It is argued that measures of group identity emphasise the degree of collective orientation to the group (Gómez et al., 2011). Identified people tend to direct their positive sentiments to their group as a whole, rather than the individual group members.

All cultures form both collective and relational ties, but the ratio of one to the other is different among different cultures (Brewer & Chen, 2007). For example, members of East Asian cultures tend to have more relational ties, and perceive the groups they are a part of as more personal. Western, individualist cultures tend to perceive the groups they are a part of as more categorical. Because people who identify with a group (as opposed to being fused to it) perceive their group members to be interchangeable, they are less likely to rush to assist their group members when these individuals are

perceived to need assistance (Whitehouse, 2012). This contrasts with how people who are fused to their group would respond.

Whitehouse (1995) conceptualised the idea of there being two different modes of group formation based on rituals - the "doctrinal" mode that utilises rituals of high frequency and low arousal (such as those rituals completed by an imagined community), and the "imagistic" mode which involves the opposite – rituals of low frequency but high arousal (such as those rituals completed by a fused group). To support this theory, Atkinson and Whitehouse (2010) coded 644 rituals from 74 cultures in terms of their frequency and the level of arousal they produced. Results showed that there was an inverse correlation between the two factors, with most rituals either frequent but of low intensity e.g., taking Holy Communion in Christian churches (Welker, 2000), or infrequent but of high arousal e.g., fingernail evulsion in Australian aboriginal initiation rites (Strehlow, 1965).

Pain promotes group affiliation

Pain, defined as "an unpleasant sensory and emotional experience arising from actual or potential tissue damage or described in terms of such damage" (International Association for the Study of Pain Task Force on Taxonomy, 1994, p. 210), sounds like a sensation to be avoided at all costs. However, pain is also associated with a number of positive outcomes for individuals, such as effective self-regulation and, for some, the facilitation of pleasure (Bastian, Jetten, Hornsey, & Leknes, 2014). Moreover, recent research suggests that pain may have positive benefits at the level of the group, by promoting affiliation and bonding.

For example, Hadjistavropoulos et al. (2011) has argued that the expression of pain confers an evolutionary advantage, not only by alerting others to a threat, but also by soliciting others' assistance. Furthermore, there is a distinct facial expression associated with pain (Williams, 2002) that can be recognised by observers, who in turn display "visceral" reactions of empathy (Craig, Versloot, Goubert, Vervoort, & Crombez, 2010). According to the perception-action model of empathy (Preston & de Waal, 2002), when we see others experiencing pain, our own representations of the experience (whether from experience or imagination) are activated, and this helps us to create shared feelings. Seeing another person in pain activates similar brain regions as are involved when directly experiencing pain (Singer et al., 2004). In studies on self-harm, it has been shown that purposefully engaging in self-harm is more effective in eliciting empathy from others than other forms of communication, for example crying (Favazza, 1996).

Pain also strengthens social ties within a group because people in pain are motivated to seek out social support (Bastian et al., 2014). There is observational evidence to support the idea that social support is an effective pain management mechanism. Cogan and Spinnato (1988) found that having a supportive companion during labour was associated with less frequent use of analgesics. Research has shown that social support is not only effective in managing acute pain, but also in dealing with more chronic pain (Gil, Keefe, Crisson & Van Dalfsen, 1987). Experimentally, it was found that participants completing a cold-pressor task with another person reported less physical pain than participants completing the task alone (Brown, Sheffield, Leary & Robinson, 2003). Interestingly, participants reported less pain in the support condition regardless of whether they were paired with a friend or stranger.

Some researchers argue that the costliness of these rituals is a way to signal true commitment to the group. Irons (2001) proposed that those who undergo painful rituals are showing their willingness to risk their bodies for the group. In a cross-cultural meta-analysis examination of this idea, Sosis, Kress and Boster (2007) provided evidence for the hypothesis that costly male rites are a way of signalling participants' commitment and solidarity to the group. Their study found that cultural groups that engaged in warfare performed the most costly rites. These are the groups who require the most commitment to the group.

Festinger's theory of cognitive dissonance (1957) provides a possible explanation as to why painful events result in group cohesion. Cognitive dissonance is the term used to describe the feeling of discomfort associated with inconsistencies between beliefs or thoughts, and actions. For example, a study by Xygalatas et al. (2013), examining two rituals in Mauritius, found that participants in the more severe ritual (involving body piercing) were more generous towards an in-group charity, and their social identity was amplified, compared with participants in a less severe ritual (involving prayer). In terms of cognitive dissonance theory, participants' feelings of pain and effort were dissonant with their willingness to participate in the ritual, and participants were able to reduce their discomfort by enhancing the positive aspects of the group and its members.

The bonding effects of pain exist not only for physical pain but also for emotional trauma. Elder and Clipp (1988) showed that the social bonding effects of trauma can last for many years. They surveyed veterans of World War II and the Korean conflict. It was found that soldiers who were involved in heavy combat were more likely than others to feel connected to the service, and that this was feeling was deepened by

traumatic events such as the loss of comrades. This study was conducted some 40 years after the men involved had suffered wartime losses.

Recently, Bastian, Jetten, and Ferris (2014) examined empirically how sharing pain with others in a small group can lead to group bonding. Participants in a "pain" condition completed a group sorting task in ice water, whereas participants in a control condition completed exactly the same task in room-temperature water. Participants in the ice water condition reported higher bonding and engaged in more co-operative behaviour in an economic game, compared to control participants. This effect was replicated when the pain involved consuming a hot chilli (versus consuming a lolly in the control condition). According to the researchers, pain focused attention on the task at hand, and made the event particularly salient (Eccleston & Crombez, 1999). When a salient experience is shared, the salience of the other people sharing the experience is also enhanced and this promotes bonding within the group (Bastian et al., 2014).

Research on "flashbulb memories" also suggests that pain and distress can focus attention. Originally coined by Brown and Kulik (1977), flashbulb memories refer to episodic memories created when one experiences a particularly surprising and arousing event. A key feature of a flashbulb memory is that individuals not only remember the event itself, but also details such as where they were, how they felt, and what happened afterwards. One of the key elements of flashbulb memory encoding is elevated arousal (Pillemer, 1984). Pillemer (1984) examined the recall of the assassination of Ronald Regan and found that those with higher emotional arousal at the time of learning about the event had greater memory of it seven months later.

Causal opacity promotes group affiliation

A second feature of many rituals is their "causal opacity" – the lack of a clear link between the performance of the ritual, and the expected outcome (Sørensen, 2007). An example of a causally opaque ritual is the act of placing a blade of a sword on a candidate's shoulder in order to confer a knighthood. Although British culture has invested this act with a function, there is no physical-causal reason for why this particular action should confer a knighthood any more than placing a hat on the candidate's head would. In contrast, a causally transparent action is one in which the purpose and mechanism of the action are known. For example, one must execute a complicated routine with strings in order to tie one's shoelaces. The string routine results in a knot, which in turn allows one to walk without tripping over. There is a clear reason for the act.

Whitehouse (2012) argues that causal opacity is a cause of rituals' bonding effects, because it encourages participants to reflect on their behaviour. This reflection produces deeper representations of the activity (Richert, Whitehouse & Stewart, 2005), which are assumed to be shared with others performing the ritual. Bastian et al. (2014) suggest that this process accounts for the group bonding observed in their cold pressor experiment described above, although the task here seems to have been transparent as opposed to opaque. Participants had to locate metal balls under the water and transport them to a small container. This "ensured that in both conditions, participants felt there was a purpose to the task."

Combining pain and causal opacity

In previous research, distress and causal opacity have been examined independently; little work has examined the interaction of the two factors. One exception is a study by Gerard and Mathewson (1966). Based on the classic study by Aronson and Mills (1959), these researchers invited participants to be part of a discussion group, where the condition of entry was an electric shock. This was either mild or severe, depending on the condition. In the initiation condition, participants were told they were receiving the shock for screening purposes – to make sure their reactions to the group discussion would not be too overdramatic. In the non-initiation condition, they were told that the experimenters simply wanted to see how they would react (that is, the shocks were not directly linked to their entry to the group). Though not framed as such, this initiation variable could be seen as a manipulation of causal opacity. The results showed that participants who experienced the severe shock rated the discussion and the discussants more positively, but only in the initiation (transparent) condition. In the non-initiation (opaque) condition, severely shocked participants rated the discussion and discussants *less* positively. In contrast to Whitehouse's (2012) account of rituals, it was the perception of purpose, not lack of purpose, which facilitated the effect of pain on group fusion.

A more recent study by Olivola and Shafir (2013) also supports the importance of meaning in the pain-fusion link. The researchers conducted a series of studies on fundraising to examine whether pain and effort lead people to contribute more money, with the hypothesis that the prospect of suffering for charity makes their contributions more meaningful. Participants' willingness to contribute to a charity was compared when asking participants about completing either a painful and effortful fundraising

event (a five mile run), or an easy and enjoyable event (an outdoor picnic). They found that although participants were equally as likely to want to take part in the two events, they pledged statistically significantly more money in the painful condition. This was replicated in a second study, which solicited real money in the context of a public goods game. Participants in a control condition simply played the public goods game, while participants in the experimental condition had to endure an aversive event first – placing a part of their body in cold water for a period of time. Participants in the latter condition donated statistically significantly more money to the public pool compared with those in the control condition. A third study, similar to the charity experiment, confirmed that perceptions of meaningfulness partially mediated the relation between the type of fundraiser and the amount of money that was donated. The experimenters theorised that the pain and effort of a strenuous fundraiser makes the experience more meaningful, which increases participants' willingness to contribute.

The present experiment

The present study proposed to examine causal opacity and pain as mechanisms of rituals' fusion effects. Research on pain is fairly conclusive – multiple studies have shown the group bonding effect of pain. However, research on causal opacity is more controversial. Some researchers argue that causal opacity brings people closer together as they are forced to reflect themselves on why they are completing the task (Whitehouse, 2012). However, other researchers suggest that participants need to understand why exactly they are performing the task in order to bond with each other (Olivola & Shafir, 2013). This study aimed to resolve these conflicting claims by examining the interaction of pain and causal opacity in a controlled environment.

Participants engaged in a cold-pressor task (submerging their hands in water) whose painfulness and causal opacity were manipulated independently. Pain was manipulated by varying the temperature of the water, while causal opacity was manipulated by the explanation offered for the task. Specifically, in the causally opaque condition, participants were not given a clear reason as to why they were completing the task, or why the water was at a specific temperature. In the transparent condition, participants were told exactly why they were immersing their hands in the water. Group members' physical proximity to each other was measured, as well as their fusion, identification, and co-operation. The participants also completed these latter measures one week later.

We predicted an interaction between causal opacity and pain. In the pain condition, we expected that because participants are searching for meaning for their suffering, they would show more cooperation, rate themselves as more fused, and sit closer together when the task is transparent. In the control condition, pain is not driving the participants towards meaning so there should be no difference between the transparent and opaque conditions.

Method

Participants

Ninety-six female psychology undergraduates (M_{age} = 18.94, SD = 1.23) from the University of Otago participated in this study, in groups of three or four, in exchange for partial course credit. The data for one participant was not included in the analyses because they did not meet the demographic criteria of being Caucasian.

Experimental manipulation

The experimental manipulation consisted of an adapted version of the cold pressor task (White & Gildea, 1937), with pain and causal opacity manipulated independently across four conditions. In all conditions, groups of three or four participants submerged their hands (up to the wrist) at the same time in a 25cm x 30cm x 50cm plastic bin containing 40 litres of water, which stood on a round, 100cm in diameter, 60cm high table. Participants were asked to submerge their hands in the water for three intervals of 45 seconds. During this time, participants closed their eyes and counted aloud as a group, using a metronome (set to one 1 click per second) as an external reference. Pain was manipulated by varying the temperature of the water (5-10°C in the pain condition and 35-37°C in the control condition). The temperature was verified with a thermometer prior to each experimental session.

Causal opacity was manipulated by varying the framing of the task. In the transparent condition, participants were told that they were submerging their hands in order to increase their blood pressure, which in turn would improve their mental functioning. In the opaque condition, participants were not told the point of the task, but were simply

informed that, in the past, undergraduate students had completed the task as a part of the university's orientation week. For the full instructions, see Appendix A.

Pre-manipulation measures (see Appendix B)

Emotional State. Participants' momentary emotional state was measured using Russell, Weiss and Mendelsohn's (1989) Affect Grid, which represents mood along two dimensions – pleasure-displeasure (horizontal) and arousal-sleepiness (vertical). Participants reported how they were feeling "right now" by ticking the appropriate box within the 9x9 grid. This measure has been used extensively in previous research and has demonstrated high reliability and validity (Holbrook & Gardner, 1993).

Self Esteem. Self-esteem was measured on Rosenberg's (1965) 10-item Global Self-Esteem Scale, which includes items such as 'I feel that I have a number of good qualities" and "At times, I think I am no good at all' (reverse scored). Participants indicated their agreement with statements using a 1 (strongly disagree) to 4 (strongly agree) scale. This scale has been used widely, with a recent meta-analysis confirming its reliability ($\alpha = .81$) and cross-cultural relevance (Schmitt & Allik, 2005).

Individualism-Collectivism. Individualist or collectivist orientation was measured on the 14-item Horizontal-Vertical Individualism-Collectivism scale (Sivadas, Bruvold, & Nelson, 2008). Participants rate their agreement with statements such as 'I usually sacrifice my self-interest for the benefit of the group' on a 1 (strongly disagree) to 7 (strongly agree) scale. This scale has been validated cross-culturally and has shown to be reliable across six samples from four countries (Sivadas et al., 2008).

Post-manipulation measures (See appendix C)

Task perception. To analyse linguistic indicators of social thoughts, participants were asked about their perceptions of the meaning of the cold pressor task. They were asked to write down their thoughts about what the activity meant to them, and what it may have been intended to do and symbolise.

Fusion. Group fusion was measured both pictorially and verbally. The pictorial measure was developed from the Inclusion of Other in the Self Scale (Aron, Aron, & Smollan, 1992) and adapted by Swannet al. (2009). Participants were presented with a series of pictures of two circles, to represent the self and the group, with varying degrees of overlap. Participants are asked to choose which picture best represents their relationship to the group. Fusion was also measured with a three-item version of Gómez et al.'s(2011) fusion scale, on which participants rate their agreement with statements such as 'I am one with my group' on a 1 (strongly disagree) to 7 (strongly agree) scale. Participants completed the fusion measures with respect to their experimental group. The verbal and pictorial measures are highly correlated, and both have been shown to have high validity (Gómez et al., 2011).

Identification. Group identification was measured using a four-item scale (Sani, Madhok, Norbury, Dugard & Wakefield, 2014) including statements such as, "I feel committed to my group." As with ratings of fusion, participants answered the questions with respect to their experimental group, indicating their agreement on a 1-7 scale. The presentation order of the fusion and identification scales was counterbalanced.

Behavioural affinity. Participants were videotaped as they completed a "desert survival" task developed by Lafferty and Pond (1974), in which they imagined being stranded in a desert after a plane crash. Participants were asked to rank, as a group, 15 items in order of their importance to their survival, following ten minutes of discussion(participants also ranked the items individually both before and after the group discussion). Participants' behaviour during the group discussion was coded for several indicators of affinity, such as smiling and making eye contact (see Results section for details). Following the ranking task, participants were asked to estimate how well their group had performed (as a percentage correct, based on rankings of a survival expert), noting that the average score is 33.4%, how well their group had worked together (1, very poorly, to 7, very well), and how much influence they felt they had over their group (1, very little, to 7, very much).

Trust. To measure trust, participants completed a modified 'Stag Hunt' game (Skyrms, 2003). The game involved a choice between two options: A and B. If the participant chose Option A, they earned NZ$5, guaranteed. If the participant chose option B, they earned NZ$10, but only if all of the other members of the group also chose option B: if this was not the case, they earned nothing. The dollar amounts associated with each choice were derived from a pre-test of 57 participants.

Religious Belief. Religiosity was measured using the Supernatural Belief Scale (Jong, Bluemke, & Halberstadt, 2013). Participants rate their agreement with ten statements such as 'There is a spiritual realm besides the physical one' on a -4 (strongly disagree) to 4 (strongly agree) scale. These data were collected for an unrelated purpose and are not discussed further.

Procedure

After giving informed consent, participants answered some demographic questions, along with the affect grid, self-esteem and individualist/collectivist orientation measures (always in that order), on paper. Participants were then led as a group into a private experimental room inside the laboratory, where they completed the cold pressor task under one of the four experimental framings, randomly determined.

Immediately after the cold pressor task, participants were invited to sit around a large table in another room to complete the following measures, always in this order: (1) a second affect grid; (2) perceptions of the task's meaning; (3) a measure of how comfortable they were during the task (1, very comfortable, to 7, very uncomfortable); and (4) the pictorial and verbal fusion and group identification scales, counterbalanced. Participants' seating positions were also recorded as a behavioural measure of interpersonal distance. Following these self-report measures, participants completed the group coordination measure (the desert survival task).

Finally, participants were assigned to private booths within the laboratory, where they completed the group performance measures, and indicated whether they knew any other members of their group before completing the experiment. Finally, participants completed the 'Stag Hunt' before being partially debriefed and dismissed.

A week after the conclusion of the experiment, participants were re-contacted by email and asked to complete the following dependent measures again: the affect grid, their perceptions of the task, the pictorial and verbal fusion measures, and the identification

measure. The fusion and identification measures were again counterbalanced. At this point, they were fully debriefed by email.

Results

Unless stated otherwise, the following variables were entered into a series of 2 (opaque versus transparent) x 2 (pain versus control) two-way analyses of variance (ANOVAs).

Manipulation checks

Ratings of pleasantness and alertness (from the affect grid) were taken immediately after the experimental manipulation, controlling for baseline pleasantness and alertness. Main effects of pain emerged for pleasantness, $F(1, 95) = 24.97$, $p < .001$, and alertness, $F(1, 95) = 18.61$, $p < .001$, such that participants in the control condition felt more pleasant ($M = 6.83$, $SE = .21$ versus $M = 5.60$, $SE = .22$) and less alert ($M = 4.98$, $SE = .30$ versus $M = 6.63$, $SE = .21$) than participants in the pain condition. The experiment failed to reject the null hypothesis of no difference between the opaque and transparent conditions. A causal opacity x pain interaction emerged on pleasantness, $F(1, 95) = 4.44$, $p < .05$, reflecting the fact that the difference between the pain and control conditions was greater when the purpose of the task was opaque ($M = 7.32$, $SE = .24$ versus $M = 5.36$, $SE = .28$),$t(1, 44) = 5.33$, $p<.001$) than when it was transparent ($M = 6.39$, $SE = .32$ versus $M = 5.94$, $SE = .35$) $t(1, 44) = .92$, $p = .36$.

The analyses also revealed a main effect of pain on comfort ratings, $F(1, 95) = 49.54$, $p < .001$; participants reported being statistically significantly less comfortable in the pain than in the control conditions ($M = 4.60$, $SE = 1.85$ versus $M = 2.72$, $SD = 1.89$). This analysis also revealed a statistically significant pain x causal opacity interaction, $F(1, 94) = 3.97$, $p < .05$, reflecting the fact that the difference between the pain and control conditions was greater when the purpose was opaque, ($M = 4.96$, $SE = .21$

versus M = 2.56, SE = .6), t(1,48) = 7.18, p < .001 than when it was transparent, (M = 4.29, SE = 0.29 versus M = 2.94, SE = 0.27), t(1, 44) = 3.20, p < .005.

Including pleasantness, alertness, or comfort ratings as covariates did not change the results of any analysis reported below.

Task perception

The Linguistic Inquiry and Word Count (LIWC) program (Pennebaker, Booth & Francis, 1999) was used to analyse participants' open-ended descriptions of their perceptions of the task. LIWC automatically identifies and categorises textual responses into particular categories of interest, which are expressed as a percentage of the total number of words in the coded passage. First person plural pronouns (e.g., we, us, our) and words related to social processes (e.g., talk, share, mate) were the categories of interest in the present experiment. The analysis of pronouns revealed only a main effect of opacity, F(1, 95) = 5.12, p < .05, such that participants used a greater proportion of such words in the transparent condition than in the opaque condition (M = 3.05, SE = .59 versus M = 1.53, SE = .41).The analysis of social words yielded a statistically significant interaction, F(1, 95) = 10.25, p < .005, such that participants in the opaque condition used a greater proportion of social words when the task was painful (M = 10.74, SE = 1.28 versus M = 7.14, SE = .95), t(1, 48) = -2.26, p < .05, but the reverse was true in the transparent condition (M = 12.48, SE = 1.32 versus M = 8.17, SE = 1.19) t(1, 44) = 2.26, p < .05. The interaction is depicted in Figure 1.

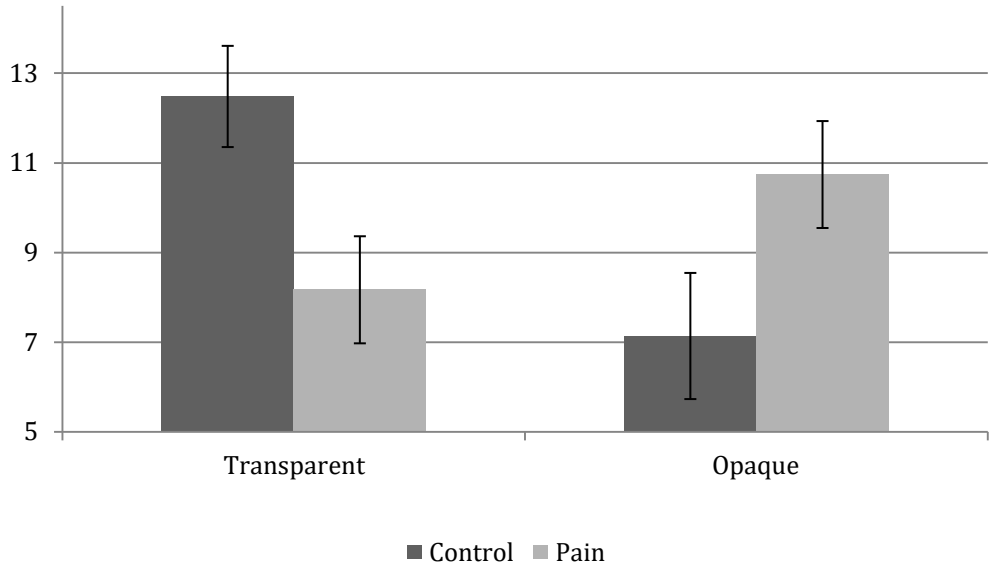


Figure 1 Number of Social Words by Causal Opacity and Pain with Standard Errors

Fusion and identification

The analysis of fusion failed to reject the null hypothesis of no difference between the opaque and transparent conditions, but did yield a statistically significant opacity x pain interaction, $F(1, 95) = 4.96$, $p < .05$. Participants in the transparent condition felt equally fused in the control condition as in the pain condition. However, participants in the opaque condition felt more fused in the control condition than in the pain condition. See Tables 1 and 2 and Figure 2.

Table 1 Independent t-test comparing the means of participants' fusion scores

	Condition	*Mean*	*Std. Error Mean*	*t*	*df*	*Sig. (2-tailed)*
Transparent	Control	3.38	0.20	-0.68	44	0.50
	Pain	3.59	0.24			
Opaque	Control	3.84	0.14	2.82	48	0.01
	Pain	3.21	0.17			

Table 2 Independent t-tests comparing the means of participants' identification scores

	Condition	*Mean*	*Std. Error Mean*	*t*	*df*	*Sig. (2-tailed)*
Transparent	Control	3.60	0.15	-2.43	44	0.02
	Pain	4.19	0.19			
Opaque	Control	3.98	0.15	-0.62	48	0.54
	Pain	4.12	0.17			

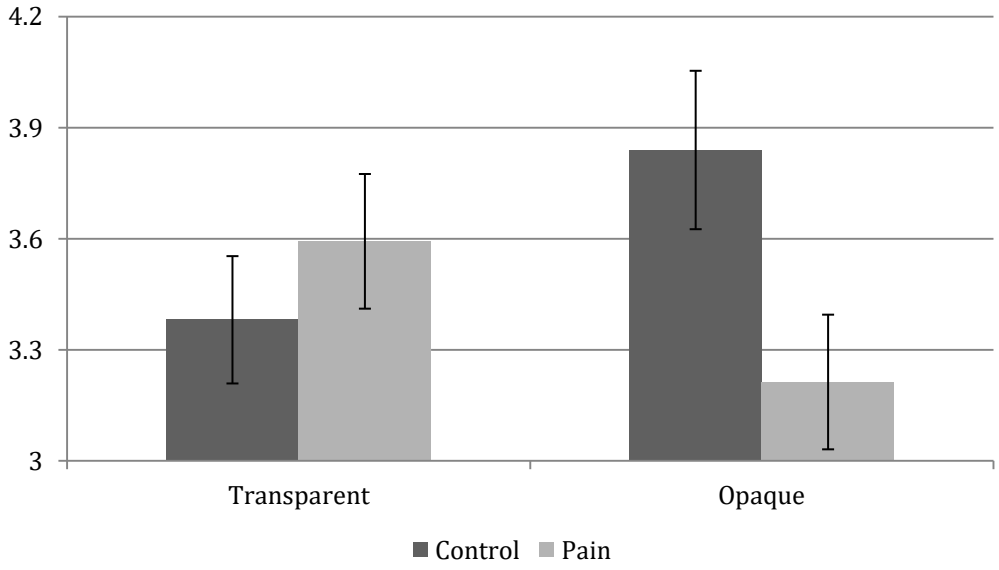


Figure 2 Group Fusion by Causal Opacity and Pain with Standard Errors

This interaction did not emerge, however, for identification, $F(1, 95) = 1.87$, *ns;* rather, a statistically significant main effect of pain emerged, $F(1, 95) = 4.86$, $p < .05$, such that participants felt more identified in the pain condition ($M = 4.15$, $SE = 0.11$) than in the control condition ($M = 3.78$, $SE = 0.13$).

Behavioural affinity

Two research assistants unaware of the research hypotheses coded four individual- and three group-level indices of rapport, based on Tickle-Degnen and Rosenthal's (1990) meta-analysis. The individual level variables were the number of times each participant expressed non-verbal positivity (i.e., smiles, nods, laughter, and eye contact). The group-level variables were the extent of the group's coordination (the extent to which group members faced their group, the openness of their posture, and the extent to which they mimicked other group members' postures). The group level variables were judged on 1-7 scales. The coders also rated each participant's fusion with the group, using the Inclusion of Other in the Self Scale (Aron et al., 1992) as well as participants' physical proximity to the group (1 = very distant to 7 = very close). Finally for each group as a whole, the following variables were rated: the extent to which participants contributed equally (1 = one participant dominated the discussion, 7 = all participants contributed an equal amount); how well participants worked together (1 = not well at all, 7 = very well); the group's performance on the desert survival task (as a percentage correct).

Intercoder reliability

Intercoder reliability was measured by calculating Pearson correlations between the two coders' ratings on each variable, which appear in Table 3. As seen in the table, agreement on several variables was qualitatively poorer than others; only the latter were analysed further.

Table 3 Summary of Pearson's correlation coefficients for behavioural affinity

Variable	*r*	*p*
Smiles	.615	000
Nods	.664	.000
Laughs	.740	.000
Eye contact	.698	.000
Away vs. towards posture	.234	.241
Open vs. closed posture	.057	.779
Mirror posture	.150	.456
Perceived fusion	.632	.000
Proximity	.627	.000
Contribute	.040	.843
Work together	.281	.156
Performance	.037	.856

The four non-verbal positivity correlates of rapport (smiles, nods, laughter, and eye contact) were averaged across to create a composite variable described from here on as 'rapport'. An ANOVA on this variable yielded main effects of opacity, $F(1, 95) = 6.95$, $p < .05$, such that participants in the transparent condition showed more rapport then participants in the causally opaque condition ($M = 3.83$, $SE = .29$ versus $M = 3.09$, $SE = .18$). There was also a main effect of pain $F(1, 95) = 4.26$, $p < .05$, such that participants in the pain condition showed more rapport than participants in the control condition ($M = 3.75$, $SE = .94$ versus $M = 3.19$, $SE = .20$)

The analysis of perceived fusion yielded a statistically significant interaction, $F(1, 95) = 7.11$, $p < .01$,such that participants in the transparent condition were judged as more fused in the painful condition than in the control condition ($M = 5.06$, $SE = .26$ versus $M = 4.36$, $SE = .24$) $t(1, 44) = -1.93$,$p = .06$, but the reverse was true for participants in the opaque condition ($M = 5.00$, $SE = .25$ versus $M = 4.40$, $SE = .22$) $t(1, 48) = -1.84$,$p = .07$. See Figure 3.

The experiment failed to reject the null hypothesis of no difference between the control and pain conditions, or between the opaque and transparent conditions for perceived proximity, participants' self-reports regarding how participants thought they had performed, how well they thought their group had worked together, and how much influence they felt they had over their group.

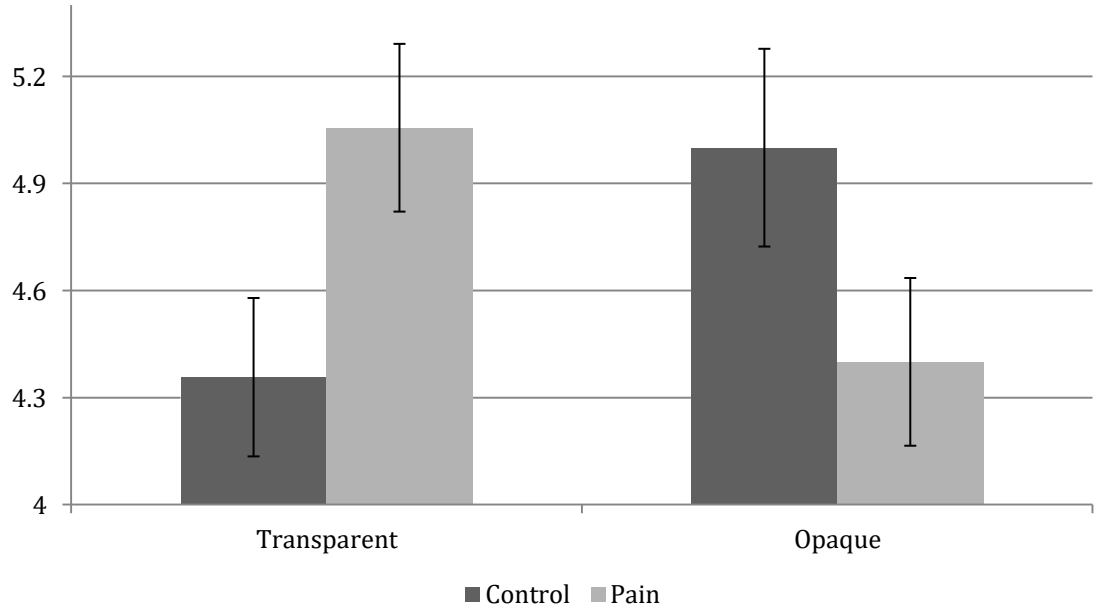


Figure 3 Perceived Fusion by Causal Opacity and Pain with Standard Errors

Performance on the survival measure

The survival task was used as a way to generate interactions, so that participants' behavioural affinity could be analysed; there were no predictions regarding participants' performance on the task. However, for exploratory purposes, accuracy scores were computed by averaging, for each participant, the absolute discrepancies of their rankings from those of survival expert Alonzo W. Pond, (Lafferty & Pond, 1974). Although the experiment failed to reject the null hypothesis of no difference between the control and pain conditions, or between the opaque and transparent conditions for

the rankings of the group as a whole, an ANOVA on participants' individual post-discussion scores revealed a main effect of opacity, $F(1, 95) = 4.64$, $p < .05$, such that participants in the opaque condition scored statistically significantly lower (and thus performed better) than participants in the transparent condition ($M = 62.08$, $SE = 1.83$ versus $M = 67.20$, $SE = 1.45$).

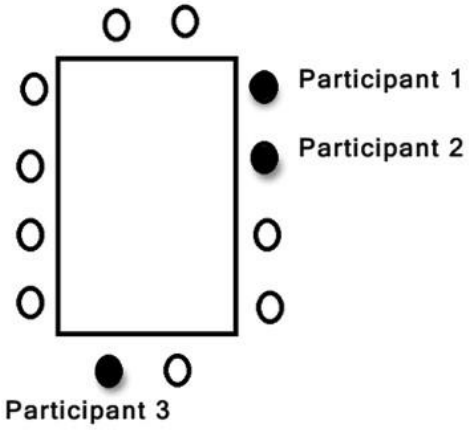
Trust

In the modified Stag Hunt game, 44.8% of participants chose option A (earning NZ$5 guaranteed), and 55.2% of participants chose option B (earning NZ$10 if all of the other members of their group also chose option B, but earning nothing if this wasn't the case). The experiment failed to reject the null hypothesis of no difference as a function of experimental conditions.

Seating position

Seating position was coded at the group level in terms of how many open seats lay between the group members, such that higher numbers represented more open seats, and therefore greater distance. See an illustration of this coding method in Figure 4. This analysis revealed main effects of pain, $F(1, 95) = 7.12$, $p < .005$, and of opacity $F(1, 95) = 36.52$, $p < .005$. Participants in the pain condition sat closer to each other ($M = 3.00$, $SE = 0.18$) than those in the control condition ($M = 2.56$, $SE = 0.21$). Participants in the transparent condition sat closer together ($M = 2.13$, $SE = 0.19$) than those in the opaque condition ($M = 3.42$, $SE = 0.16$). These main effects were qualified, however, by a statistically significant interaction, $F(1, 95) = 4.64$, $p < .05$. Participants in the opaque condition sat just as close to each other in the control condition ($M = 3.48$, $SE = 0.21$) as in the pain condition ($M = 3.36$, $SE = 0.24$), $t(1,48) = .38$, $p = .71$,

whereas participants in the transparent condition sat closer in the pain condition (M = 1.44, SE = 0.12) than in the control condition (M = 2.57, SE = 0.26), $t(1, 48) = 3.27$, $p <$ .005. This interaction is depicted in Figure 5.



Coding was based on the number of empty seats that lay between the participants. For example, in the scenario presented, all three participants would receive a score of 3 because there are three empty seats in total between the participants.

Figure 4 Seating Position Coding

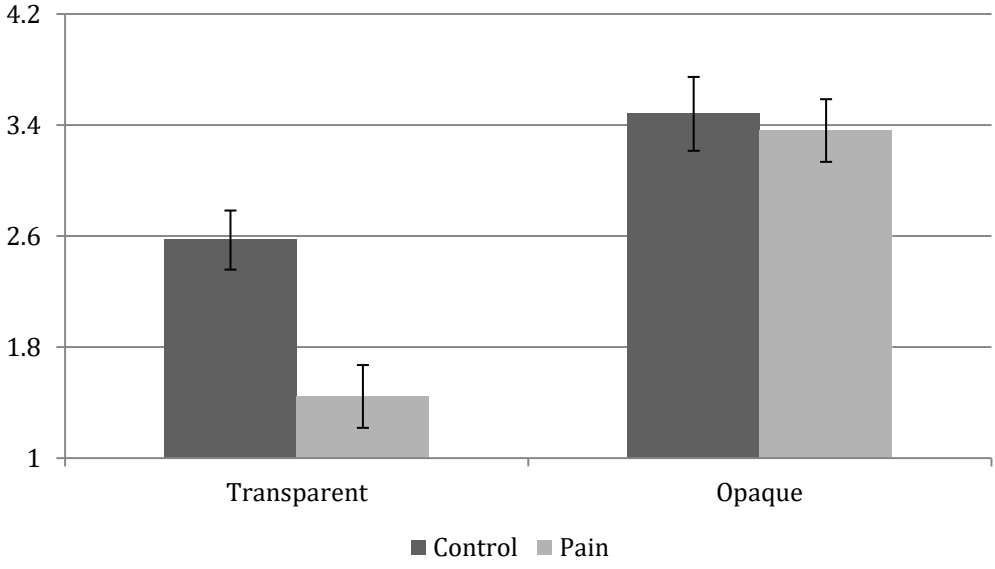


Figure 5 Group Seating Position by Causal Opacity and Pain with Standard Errors

Follow-up self-reported fusion and identification

Participants also completed four self-report measures (the affect grid, their perceptions of the task, the pictorial and verbal fusion measures, and the identification measure) one week after having completed the experiment, via email. All participants provided data (a 100% response rate). Analyses of these variables yielded only a marginal effect of causal opacity, $F(1, 95) = 3.32$, $p = .072$, such that participants in the opaque condition felt more fused than those in the transparent condition $M = 3.47$, $SE = .18$ versus $M = 3.37$, $SE = .14$.

Discussion

Summary of Results

The main aim of this study was to investigate causal opacity and pain as mechanisms of rituals' fusing effects. Previous research has found that sharing pain with others in a small group leads to group bonding, but has been inconclusive regarding causal opacity. Some researchers argue that causal opacity brings people closer together as they are forced to reflect themselves on why they are completing the task (Whitehouse, 2012). However, other researchers suggest that participants need to understand why exactly they are performing the task in order to bond with each other (Olivola & Shafir, 2013). This study aimed to resolve these conflicting claims by examining the interaction of pain and causal opacity in a controlled environment.

The present study supports the hypothesis that pain in itself has a bonding effect on group members. The hypothesis regarding causal opacity was that when participants are in pain, they will feel closer to each other only when they are given a reason for their suffering. This hypothesis was partially supported.

Pain

The hypothesis that sharing pain with others in a small group can lead to group bonding was supported. Participants self-reported as feeling more identified, showed more rapport and sat closer to each other in the pain condition compared with the control condition. These results are consistent with Bastian et al. (2014) who reported stronger bonding of participants in the painful condition than in the control condition. The results also support work conducted by Xygalatas et al. (2013), who found that

participants in a more severe ritual that involved pain had amplified social identity compared with those in a less severe condition. The experiment failed to reject the null hypothesis of no difference between the control and pain conditions for the economic goods game that was designed to measure trust. This is unexpected as previous researchers found participants to be more co-operative in an economic game when in the pain condition compared to the control (Bastian et al., 2014). Although there are many similarities in the methodology of the present study and the study conducted by Bastian and his colleagues, a major difference is that Bastian et al. (2014) used a six iteration version with seven options, while the present experiment used a single iteration with only two options.

Causal opacity

There was no hypothesis made for the main effects of causal opacity – only for its interaction with pain. However, some main effects emerged. In the transparent condition, participants used a greater number of pronouns, showed more rapport, and sat closer together than participants in the opaque condition. In the opaque condition, participants performed better in the survival task and self-reported as being more fused in the follow-up questionnaire than those in the transparent condition. The experiment failed to reject the null hypothesis of no difference between the opaque and transparent conditions for identification. This is in line with research by Whitehouse (2012) that proposes that high arousal-low frequency rituals will affect group fusion but not group identification. The results from the opaque condition support Whitehouse's theory (2012), which proposes that causal opacity encourages participants to reflect on their behaviour, producing deeper representations of the activity. These are assumed to be shared with others performing the activity.

Interaction of pain and opacity

The hypothesis regarding causal opacity was that when participants are in pain, they will feel closer to each other only when they are given a reason for their suffering. That is, participants will feel closer in the transparent condition, but when they are not in pain, they will feel closer in the opaque condition. This hypothesis was partially supported.

Results of the analysis of social words showed that in the opaque condition, participants used a greater number of social words when the task was painful, but the reverse was true in the transparent condition. An interaction of causal opacity and pain for self-reported fusion showed that in the transparent condition, the experiment failed to reject the null hypothesis of no difference between the control and pain conditions but in the opaque condition, participants felt more fused in the pain condition. These results support Whitehouse's research that in rituals that are causally opaque, pain brings people closer together. The lack of a statistically significant difference in the transparent condition for fusion is surprising as research by Bastian et al. (2014) found that when participants were aware of the reason for completing the task, pain brought people closer together.

Blind coders who watched a video of participants completing a survival task perceived participants in the transparent condition to be more fused in the pain condition compared to the control but the reverse was true in the opaque condition – when participants did not have a reason for why they were completing the task, they were perceived to be more fused in the control condition versus in the pain condition. Similar results were found for the behavioural measure of seating position. Participants in the

opaque condition sat just as close to each other in the pain condition as in the control condition, but in the transparent condition they sat statistically significantly closer in the pain condition than in the control condition. These results support work found by Olivola and Shafir (2013) who found that perceptions of meaningfulness partially mediated the relation between the type of fundraiser (painful and effortful versus easy and enjoyable) and the amount of money donated, theorising that pain makes the experience more meaningful which increases participants' willingness to contribute. These results, however, do not support work conducted by Whitehouse (2012), who argued that regardless of the presence of pain, participants will feel closer to each other in a causally opaque condition because they are experiencing a shared meaning. Fischer, Callander, Reddish, and Bulbulia (2013) also found this effect. Rituals that were judged to be more sacred were associated with higher contributions in a public goods game, and sacred values mediated the effects of synchronous movements in a ritual on prosocial behaviours. We can consider that if a ritual were judged to be more sacred, it may mean more to the people participating in it.

These inconsistencies with previous research raise the question of what exactly 'causal opacity' is. Hermann, Legare, Harris, and Whitehouse (2013) define causal opacity as an instance where "a physical causal rationale for the action is unavailable". Perhaps the difference between Whitehouse's research and the current results is that the opaque condition in the present experiment is more opaque than rituals observed in the field. For example in South Africa young men are circumcised as teenagers as a traditional way of entering manhood (Mbuyiselo, Xavela & Vincent, 2014). Before they complete the ritual, they may not know exactly what is involved. However, they do know that young men before them have completed the ritual and have then been treated

differently by members of the community in which they live. Although they cannot see the step-by-step process between undergoing pain and "becoming a man", they do see that there is an outcome of their suffering. In the present experiment, participants were simply told they were completing the experiment because others have done this before them, and that is what has always been done. They are not given any meaning for why they are completing the task at all, and are not aware of any possible outcomes after having completed the task.

Limitations

The task that was used for this study was a simulation – a task created solely for this experiment with no roots in established culture or religion. This was done to control for participants' own opinions and impressions of the task; that is, in the hope that no religion or cultural affiliations of the participants impacted the results. Unfortunately, this means that the task probably did not feel as authentic to the people involved as a ritual in the field would.

Only female participants who identified as being New Zealand European were used in this experiment. The aim of having non gender mixed groups was to avoid any noise that could have been created by discrimination within the groups. Logistically, it was easier to recruit all-female groups compared with all-male groups simply because there are more female under-graduate students at the University of Otago. However, often, men perform the extreme rituals (for example Xygalatas et al., 2013) so it would be interesting to compare the results found in the present experiment with a similar study of all-male groups.

The idea in the transparent condition was to give the participants a meaning for the task by explaining why they were performing it. Although participants were asked an open ended question about what the task meant to them, it may have been helpful to use a Likert scale to measure meaningfulness as this would have given a more quantifiable response.

Strengths

In contrast to experiments in the field, this study was conducted in the laboratory. This means that conditions were controlled for where this has not been previously possible. For example, participants closed their eyes while completing the task to eliminate the possibility that seeing others in pain was the reason for the group bonding. Participants were not able to see the distinct facial expression associated with pain (Williams, 2002) that causes observers to display empathy (Craig et al., 2010).

The study used a comprehensive range of measures. A number of self-reported measures were used, and blind coders coded perceived fusion. Seating position was also recorded as a behavioural measure. By using a number of different measures that yielded similar directions of results, we were able to be more confident.

Real-life implications

There are both positive and negative implications of creating highly fused groups. Gomez et al. (2011) used the pictorial measure of fusion to predict endorsement of pro-group behaviour such as fighting and dying for one's country. In their first study, participants completed a verbal measure of fusion, and were then asked a variation of the trolley dilemma. Specifically, each participant was asked to imagine that five of his

or her in-group members (in this case, Spaniards) were in the path of a runaway trolley. The participant could either take their own life and save their fellow in-group members by jumping into the path of the incoming trolley, or allow the trolley to continue on its path, killing the five in-group members. Results showed that 74% of fused people chose to sacrifice themselves and 79% of non-fused people chose to let the trolley kill the five other Spaniards. In the second study, participants were asked to imagine that a trolley was approaching a train station where terrorists had recently detonated several bombs. A trolley was approaching the trolley station, and said terrorists were running along the tracks alongside that which the trolley was traveling. Participants spotted a fellow Spaniard prepared to leap onto the tracks. This would kill the Spaniard, but would cause the trolley to veer onto the tracks where the terrorists were running. Each participant was given the option of allowing his fellow Spaniard to jump, or to push him out of the way and instead throw themselves onto the tracks, sacrificing their own life. Results showed that 69% of fused persons chose to take their own life, while 89% of non-fused persons chose to let the fellow Spaniard be killed.

Similar to the implications of creating highly fused groups, there is evidence to suggest that group cohesiveness is an aid in motivation. Stouffer et al. (1949) worked from large samples of soldiers who fought in World War II to discover what motivated them to keep going during the war. They found that the second most common response referred to the strong bonds that had developed between themselves and their fellow soldiers. They also found that after prayer, loyalty to their companions was their biggest source of comfort. However, subsequent research has criticised the methodology of this study (MacCoun, Kier & Belkin, 2006).

Research has also found links between group cohesiveness and performance. Martens and Peterson (1971) examined this relationship among basketball teams. This study involved 1200 male university students from 144 basketball teams. Cohesiveness was measured using a questionnaire at the beginning and end of the season. The number of games the team won was the measure of the team's performance. Results showed that the two measures of cohesiveness, degree of teamwork and closeness were all statistically significantly higher for the more successful teams compared to the unsuccessful teams.

On the negative side, there is a motivating role of fusion in extreme behaviours such as terrorism. Thus, we can say that fused groups are beneficial to the in-group, but can be harmful to the out-group. Understanding how the imagistic mode of group formation leads to highly fused groups is an important part of predicting how groups will react in different situations.

Conclusion

This study represents the first experimental research examining how pain and causal opacity combine to produce group bonding. Results showed that group bonding depended on both of these mechanisms. When the purpose of the task was transparent, participants sat closer together and were perceived to be more fused in the pain condition. When the purpose of the task was opaque, participants reported feeling more fused in the control condition than in the pain condition. These findings suggest that when they are in pain, people search for a reason for their suffering. These findings should be applied to real world situations where pain is used as social glue (e.g.,

initiation rituals) to examine the theory that participants who believe they are suffering pointlessly may not experience group bonding effects.

References

Anderson, B. (1983). *Imagined communities: Reflections on the origin and spread of nationalism*. London: Verso.

Aron, A., Aron, E., & Smollan, D. (1992). Inclusion of other in the self scale and the structure of interpersonal closeness. *Journal of Personality and Social Psychology, 63,* 596-612.

Aronson, E., & Mills, J. (1959). The effect of severity of initiation on liking for a group. *Journal of Abnormal and Social Psychology, 59*, 177–181.

Atkinson, Q. & Whitehouse, H. (2010). The cultural morphospace of ritual form: Examining modes of religiosity cross-culturally. *Evolution and Human Behavior, 32*, 50–62.

Bastian, B., Jetten, J., & Ferris, L. (2014). Pain as social glue: Shared pain increases cooperation. *Psychological Science, 25,* 2079-2085.

Bastian, B., Jetten, J., Hornsey, M., & Leknes, S. (2014). The positive consequences of pain: A biopsychosocial approach. *Personality and Social Psychology Review, 18,* 256-279.

Brewer, M. & Chen, Y. (2007). Where (and who) are collectives in collectivism: Toward conceptual clarification of individualism and collectivism. *Psychological Review, 114*, 133-151.

Brewer, M. & Gardner, W. (1996). Who is this "we"? Levels of collective identity and self representations. *Journal of Personality and Social Psychology, 71,* 83-93.

Brown, R. & Kulik, R. (1977). Flashbulb memories. *Cognition, 5,* 73-99.

Brown, J., Sheffield, D., Leary M., & Robinson, M. (2003). Social support and experimental pain. *Psychosomatic Medicine, 65,* 276-283.

Byard, R. & Simpson, E. (2005). Characteristic acquired features of indigenous Australians that may be observed in forensic practice. *Forensic Science, Medicine and Pathology, 1,* 207-213.

Cogan, R., & Spinnato, J. (1988). Social support during premature labour: Effects on labor and the newborn. *Journal of Psychosomatic Obstetrics and Gynaecology, 8,* 209-216.

Craig, K., Versloot, J., Goubert, L., Vervoort, T., & Crombez, G. (2010). Perceiving pain in others: Automatic and controlled mechanisms. *Journal of Pain, 11,* 101-108.

Eccleston, C., &Crombez, G. (1999). Pain demands attention: A cognitive-affective model of the interruptive function of pain. *Psychological Bulletin, 125,* 356-366.

Elder, G. & Clipp, E. (1988). Wartime losses and social bonding: Influences across 40 years in men's lives. *Psychiatry: Interpersonal and Biological Processes, 51,* 177-198.

Favazza, A. (1996). *Bodies under siege: Self-mutilation and body modification in culture and psychiatry.* Baltimore, MD: Johns Hopkins University Press.

Festinger, L. (1957). *A theory of cognitive dissonance*. Stanford, CA: Stanford University Press.

Fischer, R., Callander, R., Reddish, P., & Bulbulia, J. (2013). How do rituals affect cooperation? *Human Nature, 24,* 115-125.

Gerard, H., & Matthewson, G. (1966). The effects of severity of initiation on liking for a group: A replication. *Journal of Neuroscience, 2,* 278-287.

Gil, K., Keefe, F., Crisson, J. & Van Dalfsen, P. (1987). Social support and pain behavior. *Pain, 29,* 209-217.

Gómez, Á., Brooks, M., Buhrmester, M., Vázquez, A., Jetten, J. & Swann, W. (2011). On the nature of identity fusion: Insights into the construct and a new measure. *Journal of Personality and Social Psychology, 100,* 918-933.

Hadjistavropoulos, T., Craig, K., Duck, S., Cano, A., Goubert, L., Jackson, P., Mogil, J., Rainville, P., Sullivan, M., de C. Williams, A., Vervoot, T., & Fitzgerald, T. (2011). A biopsychosocial formulation of pain communication. *Psychological Bulletin, 137,* 910-939.

Hermann, P., Legare, C., Harris, P., & Whitehouse, H. (2013). Stick to the script: The effect of witnessing multiple actors on children's imitation. *Cognition, 129,* 536-543.

Holbrook, M., & Gardner, M. (1993). An approach to investigating the emotional determinants of consumption durations: Why do people consume what they consume for as long as they consume it? *Journal of Consume Psychology, 1993,* 123-142.

Ibn Khaldūn, A. (1958). *The Muqaddiman: An introduction to history*. Princeton, NJ: Princeton University Press.

Irons, W. (2001). Religion as a hard-to-fake sign of commitment. In Nesse, R. (Ed.) *Evolution and the capacity for commitment.* New York: Russell Sage Foundation.

Jong, J., Bluemke, M., & Halberstadt, J. (2013). Fear of death and supernatural beliefs: Developing a new supernatural belief scale to test the relationship. *European Journal of Personality, 27,* 495-506.

Lafferty, J., & Pond, A. (1974). *Desert survival situation.* Plymouth, MI: Human Synergistics.

MacCoun, R., Kier, E. & Belkin, A. (2006). Does social cohesion determine motivation in combat?: An old question with an old answer. *Armed Forces & Society, 32,* 646-654.

Martens, R. & Peterson, J. (1971). Group cohesiveness as a determinant of success and member satisfaction in team performance. *International Review for the Sociology of Sport, 6,* 49-61.

Mbuyiselo, D., Xavela, M., & Vincent, N. (2014). Male circumcision: The determinant of social acceptance. *Journal of Men's Health, 11,* 189-195.

Merskey, H., & Bogduk, N. (1994*). International Association for the Study of Pain. Task Force on Taxonomy. Classification of chronic pain: descriptions of chronic pain syndromes and definitions of pain terms*. Seattle, WA: IASP Press

Olivola, C., & Shafir, E. (2013). The Martyrdom Effect: When pain and effort increases prosocial contributions. *Journal of Behavioral Decision Making, 26,* 91-105.

Pennebaker, J., & Francis, M. (1999). *Linguistic Inquiry and Word Count (LIWC).* Mahwah, NJ: LEA Software and Alternative Media/Erlbaum

Pillemer, D. (1984). Flashbulb memories of the assassination attempt on President Reagan. *Cognition, 16,* 63-80.

Preston, S., & de Waal, F. (2002). Empathy: Its ultimate and proximate bases. *Behavioral and Brain Sciences, 25,* 1-20.

Richert, R., Whitehouse, H., & Stewart, E. (2005). Memory and analogical thinking in high-arousal rituals. In Whitehouse, H., & McCauley, R. (Eds.), *Mind and Religion: Psychosocial and Cognitive Foundations of Religiosity.* Walnut Creek, CA: AltaMira Press.

Rosenberg, M. (1965). *Society and the adolescent self-image.* Princeton, NJ: Princeton University Press

Russell, J., Weiss, A., & Mendelsohn, G. (1989). Affect grid: A single-item scale of pleasure and arousal. *Journal of Personality and Social Pyschology, 57,* 493-502.

Sani, F., Madhok, V., Norbury, M., Dugard, P., & Wakefield, J. (2014). Greater number of group identifications is associated with healthier behaviour: Evidence from a Scottish community sample. *British Journal of Health Pyschology,*doi: 10.1111/bjhp.12119

Schmitt, D., & Allik, J. (2005). Simultaneous administration of the Rosenberg self-esteem scale in 53 nations: Exploring the universal and culture-specific features of global self-esteem. *Journal of Personality and Social Psychology, 14,* 623-642.

Singer, T., Seymour, B., O'Doherty, J., Kaube, H., Dolan, R., & Frith, C. (2004). Empathy for pain involves affective but not sensory components of pain. *Science, 303,* 1157-1162.

Sivadas, E., Bruvold, N., & Nelson, M. (2008). A reduced version of the horizontal and vertical individualism and collectivism scale: A four-country assessment. *Journal of Business Research, 61,* 201-210.

Skyrms, B., 2003. *Stag-Hunt Game and the Evolution of Social Structure.* Cambridge: Cambridge University Press.

Sørensen , J. (2007). *A cognitive theory of magic*. Walnut Creek, CA: Altamira Press.

Sosis, R., Kress, H., & Boster, J. (2007). Scars for war: Evaluating alternative signalling explanations for cross-cultural variance in ritual costs. *Evolution and Human Behavior, 28,* 234-247.

Stouffer, S. Lumsdaine, A., Harper, M., Lumsdaine, R., Williams, J., Smith., M., Janis, I., Star, S. &Cottrell, L. (1949). *The American Soldier: Combat and Its Aftermath*,Princeton, NJ: Princeton University Press

Strehlow, T. (1965). Culture, social structure, and environment in Aboriginal Central Australia. In Berndt, R. (Ed.) *Aboriginal man in Australia*. Sydney: Angus and Robertson.

Swann, W., Gómez, A., Seyle, C., Morales, J. & Huici, C.(2009). Identity fusion: The interplay of personal and social identities in extreme group behavior. *Journal of Personality and Social Psychology,96*, 995–1011.

Tajfel, H., & Turner, J. C. (1979). An integrative theory of intergroup conflict. In W. G. Austin & S. Worchel (Eds.), *The social psychology ofintergroup relations*. Monterey, CA: Brooks–Cole.

Tickle-Degnen, L., & Rosenthal, R. (1990).The nature of rapport and its nonverbal correlates. *Psychological Inquiry, 1,* 285-293.

Welker, M. (2000). *What happens in Holy Communion?* Grand Rapids, MI: Wm B. Eerdmans.

White, B., & Gildea, E. (1937). "Cold pressor test" in tension and anxiety: A cardiochronographic study. *Archives of Neurology & Psychiatry, 38,* 964-984.

Whitehouse, H. (1995). *Inside the cult: Religious innovation and transmission in Papua New Guinea.* Oxford: Oxford University Press.

Whitehouse, H. (2012). Ritual, Cognition, and Evolution. In R. Sun (ed.) *Grounding the Social Sciences in the Cognitive Sciences*. MIT Press.

Williams, A. (2002). Facial expression of pain: An evolutionary account. *Behavioral and Brain Sciences, 25,* 439-488.

Xygalatas, D., Mitkidis, P., Fischer, R., Reddish, P., Skewes, J., Geertz, A., Roepstorff, A., & Bulbulia, J. (2013). Extreme rituals promote prosociality. *Psychological Science, 24*, 1602-1605.

Appendix A: Causal opacity manipulation instructions

Thank you for signing up for our experiment, which is open to undergraduate students at the University of Otago. In this study, participants complete several tasks, and since you have all signed up for the same time and you are all undergraduate students, you will be in the same group. Your actions and performance in the experiment will be judged as a group.

Instrumental condition: Now we will complete the first activity which was developed to reliably increase participants' systolic and diastolic blood pressure, and increase blood flow to the prefrontal cortex. This has the effect of improving your mental functioning. The activity involves submerging your hands in water at a particular temperature. You can contribute to its development by providing your perception of the activity.

Causally opaque condition: Now we will complete the first activity. First year students at the University of Otago initially established this practice many years ago as a regular feature of O week. It involves submerging your hands under water at a particular temperature, which was originally defined by the students who created it. You can contribute to its development by providing your perception of the activity.

Please follow my instructions and take the task seriously. I will be asking you some questions about it later.

Please remove any watches and jewellery and stand around this table so that everyone has access to the water. Please complete this task in silence. As a group, you will close your eyes and submerge your hands under water. You will do this three times for 45 seconds each time. Make sure that your hands are submerged up to the wrist each time. Between each submersion you will have 15 seconds with your hands above the surface of the water. I am going to turn on this metronome and you will count the seconds aloud together.

Appendix B: Pre-manipulation measures

Age _____

Gender _____

Nationality _____

Religion _____

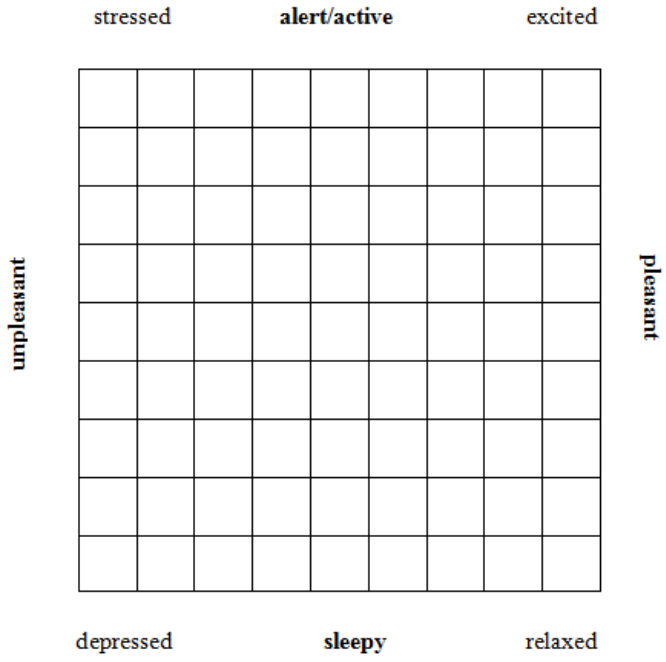
University year level _____

Is English your first language? (tick one)

[ ] Yes

[ ] No

Displayed below is an Affect Grid, with nine columns and nine rows. Going from left to right, the columns represent how pleasant or positive you feel; the farther right you go, the more pleasant the feeling. Going from bottom to top, the rows represent how active or alert or awake you feel. Using the anchors as a guide, please mark the square in the Affect Grid below that best corresponds to how you are feeling right now.



Below is a list of statements about your general feelings about yourself. For each statement:

if you strongly disagree, circle SD
if you disagree, circle D
if you agree, circle A
if you strongly agree, circle SA

On the whole, I am satisfied with myself.	SD	D	A	SA
At times, I think I am no good at all.	SD	D	A	SA
I feel that I have a number of good qualities.	SD	D	A	SA
I am able to do things as well as most other people.	SD	D	A	SA
I feel I do not have much to be proud of.	SD	D	A	SA
I certainly feel useless at times.	SD	D	A	SA
I feel that I'm a person of worth, at least on an equal plane with others.	SD	D	A	SA
I wish I could have more respect for myself.	SD	D	A	SA
All in all, I am inclined to feel that I am a failure	SD	D	A	SA
I take a positive attitude towards myself.	SD	D	A	SA

Please indicate to what extent you would agree with the following statements:

	Strongly disagree						**Strongly agree**
My happiness depends very much on the happiness of those around me.	1	2	3	4	5	6	7
I would do what would please my family, even if I detested that activity.	1	2	3	4	5	6	7
I usually sacrifice my self-interest for the benefit of my group.	1	2	3	4	5	6	7
I enjoy working in situations involving competition with others.	1	2	3	4	5	6	7
The well-being of my co-workers is important to me.	1	2	3	4	5	6	7
I enjoy being unique and different from others in many ways.	1	2	3	4	5	6	7
Children should feel honoured if their parents receive a distinguished award.	1	2	3	4	5	6	7
I often “do my own thing”.	1	2	3	4	5	6	7
Competition is the law of nature.	1	2	3	4	5	6	7
If a co-worker gets a prize, I would feel proud.	1	2	3	4	5	6	7
I am a unique individual.	1	2	3	4	5	6	7
I would sacrifice an activity that I enjoy very much if my family did not approve of it.	1	2	3	4	5	6	7
Without competition it is not possible to have a good society.	1	2	3	4	5	6	7
I feel good when I cooperate with others.	1	2	3	4	5	6	7

Appendix C: Post-manipulation measures

We are interested in your perceptions about the meaning of the activity you just performed. In the space provided below, please write down your thoughts about what the activity meant to you, and what it may have been intended to do and symbolise.

_____

_____

_____

_____

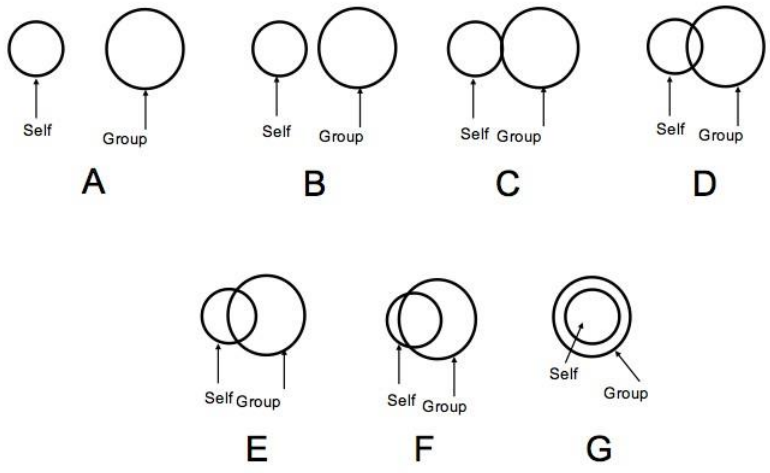
_____

Please indicate your physical comfort level during the task:

Very uncomfortable						Very comfortable
1	2	3	4	5	6	7

From this point, "group" or "my group" refers to the people who made up the group with whom you completed the task./ From this point, "group" or "my group" refers to University of Otago students.

Which pictorial representation below most closely reflects your relationship to your group? Please circle the letter below the picture that best represents your relationship with your group.



Please indicate to what extent you would agree with the following statements:

	Strongly disagree						**Strongly agree**
I am one with my group.	1	2	3	4	5	6	7
I'll do for my group more than any of the other members of my group would do.	1	2	3	4	5	6	7
I make my group strong.	1	2	3	4	5	6	7
I identify with my group.	1	2	3	4	5	6	7
I feel committed to my group.	1	2	3	4	5	6	7
I am glad to be in my group.	1	2	3	4	5	6	7
Being in my group is an important part of how I see myself.	1	2	3	4	5	6	7

The situation

It is approximately 10:00am in the middle of summer and you have just crash landed in the Sonara Desert in the Southwestern United States. The light twin-engine plane, containing the bodies of the pilot and the co-pilot, has completely burned. Only the airframe remains. None of the rest of you has been injured.

The pilot was unable to notify anyone of your position before the crash. However, he had indicated before impact that you were 110km south-southwest from a mining camp that is the nearest known habitation, and that you were approximately 110km off the course that was filed in your VFR Flight Plan.

The immediate area is quite flat, and except for occasional barrel and saguaro cacti, appears to be rather barren. The last weather report indicated the temperature would reach 40 degrees that day, which means that the temperature at ground level will be 50 degrees. You are dressed in lightweight clothing – short sleeved pants, socks, and street shoes. Everyone has a handkerchief. Collectively, your pockets contain $4.60 in change, $100 in bills, a pack of cigarettes and a ballpoint pen.

Your task

Before the plane caught fire your group was able to salvage the 15 items listed on the next page. Your task is to rank these items according to their importance to your survival. Please take five minutes to individually decide on your rankings and list them under Step 1. After this, you will take ten minutes as a group to create a collaborative list. Finally, you will again take five minutes to individually decide your rankings. The optimal answer for this simulation survival task was developed by a survival expert who spent much of his time working in the Sahara Desert. Your answer will be matched against his answer to determine your score. This is a very difficult task to complete perfectly, so if your group has the best performance, you will each earn $100. You will be contacted via email if you have done so.

Rank these survival items in order of importance (1 = the most important, 15 = the least important). You are not allowed to use the same number twice	Step 1: Your individual ranking	Step 2: Your group ranking	Step 3: Your individual ranking
Flashlight (and 4 batteries)			
Pocketknife			
Sectional air map of the area			
Plastic raincoat (large size)			
Magnetic compass			
Compress kit with gauze			
.45 calibre pistol (loaded)			
Parachute (red and white)			
Bottle of salt tablets (1000 tablets)			
1 litre of water per person			
A book entitled “Edible Animals of the Desert”			
A pair of sunglasses per person			
1 litres of 90% alcohol vodka			
One top coat per person			
A cosmetic mirror			

1. The Desert Survival Task is scored by matching your answers to those of a survival expert's, and calculating a percentage score – if your item ranking corresponded perfectly with that of a survival expert, you would score 100%, and if none of your ranks corresponded with those of a survival expert, you would score 0%. The average person's score is 33.4%; what do you think your group scored?

Predicted group score: _____

2. Please indicate how well you think your group worked together on the Desert Survival task:

Very poorly						Very well
1	2	3	4	5	6	7

3. How much influence do you think you had over the other members of your group?

Very little						Very much
1	2	3	4	5	6	7

4. Did you know any of the other members of your group before completing this experiment? (Please circle the correct answer)

No Yes

Please indicate to what extent you would agree with the following statements:

	Strongly disagree								**Strongly agree**
There exists an all-powerful, all-knowing, loving God.	-4	-3	-2	-1	0	1	2	3	4
There exists an evil personal spiritual being, whom we might call the Devil.	-4	-3	-2	-1	0	1	2	3	4
There exist good personal spiritual beings, whom we might call angels.	-4	-3	-2	-1	0	1	2	3	4
There exist evil, personal spiritual beings, whom we might call demons.	-4	-3	-2	-1	0	1	2	3	4
Human beings have immaterial, immortal souls.	-4	-3	-2	-1	0	1	2	3	4
There is a spiritual realm besides the physical one.	-4	-3	-2	-1	0	1	2	3	4
Some people will go to Heaven when they die.	-4	-3	-2	-1	0	1	2	3	4
Some people will go to Hell when they die.	-4	-3	-2	-1	0	1	2	3	4
Miracles – divinely-caused events that have no natural explanation – can and do happen.	-4	-3	-2	-1	0	1	2	3	4
There are individuals who are messengers of God and/or can foresee the future.	-4	-3	-2	-1	0	1	2	3	4

Thank you for participating in this study, for which you will earn course credit. The final part of this experimental session involves a group game, where you will have the chance to earn money in addition to your course credit.

The other participants in this game are the other members of your group, who participated with you in the study today. The game involves a simple choice between two options: A and B. If you choose Option A, you will earn $5, guaranteed. If you choose Option B, you will earn $10 – but only if other members of your group have also chosen Option B. If not, you will get $0. You can only choose one of the options.

Option A	**Option B**
$5, no matter what the other participants have chosen	$10 if the previous two participants chose Option B, otherwise $0

Which option would you like to choose? (Please circle one)

Option A Option B