

The Effects of Consensual Pain: A Look at Psychological and Physiological Changes of Giving
and Receiving Tattoos

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Abstract

Past research has observed that extreme rituals and BDSM activities have the ability to produce altered states of consciousness. Currently it is unknown what role inducing or receiving painful stimuli may have in eliciting these responses. 22 participants (5 tattoo artists, 11 clients, and 6 observers) were recruited at a local tattoo parlor. Tattoo artists were expected to enter into a state of flow (Csikszentmihalyi & Csikszentmihalyi, 1988) as measured by the SHORT Flow State Scale while any altered state of consciousness found in clients was expected to be accounted for by Dietrich's (2003) transient hypofrontality hypothesis (measured with a Stroop task via tablet). No evidence was found that participants entered into a state of flow or transient hypofrontality. Participants did show a reduction in positive affect as well as a trending reduction in negative affect. Tattoo artists and clients reported feeling closer to each other; other groups (e.g. artists and observers) had no significant changes in closeness. Ego depletion, as measured by a handgrip task, may have occurred although the small sample size, as well as hand fatigue in the tattoo artists after the tattoo procedure, may better account for this finding.

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The avoidance of pain is a basic evolutionary drive. It seems counterintuitive, then, that a myriad of examples exist of people willingly inflicting bodily harm upon themselves. While unexpected painful stimuli may be aversive, pain that can be directed and controlled may be beneficial. Scarry (1985) noted that pain has the ability to narrow one's attention to the immediate present; eventually attention is focused solely on the awareness of pain while everything else is temporarily forgotten. Pain could also be used as a way to escape from the self by achieving a loss of high-level self-awareness (Baumeister, 1988).

A prevalent method of accepted pain, either self-inflicted or brought about by a trusted individual is through an extreme ritual. An extreme ritual is a sequence of activities that involve the infliction of discomfort or pain. Extreme rituals may be dictated by the traditions of a community, often from a religious community. Throughout history and across many cultures, accounts of individuals participating in extreme rituals are readily available. For example, within the Sioux Sun Dance ceremony, individuals will have their skin pierced with sharp skewers in the breast, shoulders, or back. Raw hide thongs are then threaded through their skin and attached to a central pole or a buffalo skull. Those who are pierced will then dance for hours to the rhythmic beating of drums (Jilek, 1982). It was noted by Fischer et al. (2014) during their research at the Thimithi festival that the roles played by individuals shaped the affective experience attained. The Thimithi festival consists of a collective fire-walking ritual celebrated in Mauritius, a small island located off the East coast of Madagascar. Fischer et al. found that those who had participated in the fire-walking ritual had the highest levels of positive affect. It was proposed that this increase in affect is suggestive of an endogenous release of opioids as

well as an offset of pain mechanisms. Other examples of extreme rituals include the whip matches of the Fulani people from Benin, West Africa; The Vegetarian Festival in Phuket, Thailand; and the Bullet Ant Glove ceremony conducted by the Brazilian Satere-Mawe. Recent research has shown that participating in collective rituals promotes social cohesion (Xygalitas et al., 2013) and creates greater happiness in those who directly participate (Fischer et al., 2014).

Some BDSM (Bondage-Discipline/ Dominance-Submission/ Sadism-Masochism) activities provide another example of pleasure derived from painful stimuli. Initially perceived as solely a mental illness (Freud, 1938), continued research of BDSM activities and practitioners is beginning to offer a new perspective. A number of studies have focused on investigating the demographic characteristics of BDSM practitioners, particularly in regards to personality variables and the presence of pathology (Connolly, 2006; Wismeijer & van Assen, 2013). Baumeister (1988) had noted that many components of masochism, such as pain without permanent harm or damage, bondage, lowered personal power, and degradation facilitates an escape from the self. More recent research has begun to investigate the reasons why people choose to engage in BDSM activities by examining the psychological and physiological effects of those activities. Some of the effects include achieving an altered state of consciousness (Ambler et al., in press; Klement et al., under review), reducing psychological stress and negative affect (Ambler et al., in press; Lee et al., in press; Sagarin, Cutler, Cutler, Lawler-Sagarin, & Matuszewich, 2009) increasing closeness with others (Sagarin et al., 2009), and a greater sense of community (Klement et al., under review). Sagarin and colleagues (2009) had also noted that bottoms, or those in a BDSM scene who receive stimulation that often includes pain, also exhibited an increase in the hormone cortisol, indicative of an increase in physiological stress. This rise in physiological stress combined with reductions in self-reported psychological

stress seems to indicate that bottoms may enter into an altered state of consciousness known as transient hypofrontality.

Transient hypofrontality is a theory designed to explain the altered state of consciousness that results from a temporary down-regulation of the prefrontal cortex (Dietrich, 2003) that could be induced by activities such as meditation, exercise, hypnosis, and daydreaming. Transient hypofrontality results from the brain having a finite amount of resources and the need to delegate which areas receive those resources. Activities such as exercise cause a large portion of the brain to focus on basic perceptual processes and motor output. Although numerous brain structures are active, additional blood flow to the brain does not occur (Dietrich, 2003). In order to help balance the deficit in blood flow, brain regions that are not vital to the task at hand are down-regulated. During this time, high-order cognitive functioning is less necessary. Therefore, the frontal cortex and the prefrontal cortex are down-regulated (Del Giorno, Hall, O'Leary, Bixby & Miller, 2010; Dietrich & Sparling, 2004). Of note, people who are theoretically experiencing transient hypofrontality report reductions in the perception of pain (Dietrich, 2003). The release of endogenous opioid peptides via painful stimuli may be triggered by the same conditions that are known to induce an altered state of consciousness (Jilek, 1982).

If a person has entered into a state of transient hypofrontality then they should exhibit a reduction in performance on cognitive tests that gauge the brain's ability to demonstrate executive control. A Stroop task could indirectly gauge whether or not receiving pain plays a role in inducing a state of transient hypofrontality. Developed around eighty years ago, the Stroop test is an assessment that has been used extensively within the realm of psychology as a mean to measure interference of reaction time to a given task (MacLeod, 1991).

Inzlicht and Schmeichel (2012) found that Stroop performance decreases with the presence of ego depletion. It is plausible that individuals who are experiencing a painful ordeal could be merely exerting a deliberate endurance to the painful experience. A reliable measure for testing ego depletion is the handgrip task. Instead of measuring bodily strength, continually gripping a handgrip measures self-control (Muraven, Tice, & Baumeister, 1998). If ego depletion has occurred then the amount of time spent squeezing a handgrip will diminish. Utilizing both a Stroop task and a handgrip task would allow researchers to differentiate between whether a state of transient hypofrontality or ego depletion is reached when individuals participate in a painful activity. Data collected from Ambler et al. (in press) suggests that transient hypofrontality offers a better explanation than ego depletion when considering decreased Stroop performance in conjunction with receiving pain during a BDSM scene. Ambler and colleagues had noted that individuals who receive pain as a bottom in a BDSM scene reported decreases in psychological stress as well as decreases in negative affect. If ego depletion was the cause in the decrease in Stroop performance within these BDSM scenes, an increase in psychological stress as well as an increase in negative affect would be expected. It is expected that any activity that involves the consensual receiving of pain will have results similar to those found from Ambler et al.

Transient hypofrontality offers an explanation for those who receive painful stimuli but does not account for any psychological or physiological changes that may occur in those who administer the painful stimuli. A proposed explanation for those who direct painful stimuli onto others is Csikszentmihalyi's concept of flow. Flow is defined as an optimal mental experience that occurs when someone becomes fully immersed in an enjoyable activity that creates an energized focus (Csikszentmihalyi & Csikszentmihalyi, 1988). Nine dimensions are needed in

order to reach a state of flow: clear goals, quick and unambiguous feedback, equilibrium between challenges and skills, focused concentration, a merging of activity and awareness (the task is so enjoyable that attention becomes focused entirely on the task at hand), a sense of control over the outcomes of the activity, a distorted sense of time (time can either seem to be faster than what it actually is or can occasionally seem slower), and a loss of awareness of the self (potentially creating a transcendence of self). The ninth dimension occurs once the other eight dimensions are in place. According to Csikszentmihalyi and Csikszentmihalyi (1988), “The negentropic quality of the flow experience makes it *autotelic*” (p. 33).

At this time it is unknown if the consensual receipt of pain is sufficient for inducing transient hypofrontality. It is also unknown if a state of flow can be obtained when delivering pain in a consensual, controlled manner. The purpose of this study is to glean better insight into whether or not the administering and voluntary reception of pain elicits an altered state of consciousness. In the present study, we recruited individuals from a local tattoo parlor who self-selected to receive a tattoo as well as any guests that may accompany them. Tattoo artists who work at the parlor were also recruited. A Stroop task has been developed that can be administered via a tablet. Consistent with past findings (Ambler et al., in press, Lee et al., in press), it is predicted that those who are receiving a tattoo will exhibit higher scores on the Stroop task, indicative of a decline in cognitive performance. Tattoo artists are expected to show slight improvements while observers are not expected to show any differences. At the end of the tattoo session participants will complete an evaluation of mental flow. It is predicted that tattoo artists will report greater levels of flow than those receiving a tattoo or observers of the tattoo. A handgrip task will be implemented in order to parse out if decrements in Stroop scores are due to transient hypofrontality or because of ego depletion. Finally, we will have participants complete

paper surveys before and after the tattoo, measuring demographics and a variety of psychological variables.

Method

Participants

There was a total of 22 participants for this study: five tattoo artists, eleven participants, and six observers. Participants ranged in age from 18 to 56 ($M = 27.18$, $SD = 8.92$). Participants gave a self-report of their gender (50% female) as well as their race/ ethnicity which broke down as: 63.6% Caucasian, 18.2% Hispanic, and 13.6% as mixed race. One participant did not disclose their race/ ethnicity. Heterosexuality was the most common sexual identity (86.4%) while 9.1% of participants reported their sexual orientation as lesbian. One participant did not report their sexual orientation. Tattoo duration ranged from 29 minutes to 378 minutes ($M = 138.70$, $SD = 90.07$).

Time spent apprenticing for the tattoo artists ranged from no apprenticeship to two years ($M = 1.00$, $SD = 0.71$). Time spent as a tattoo artist ranged from one year to nine years ($M = 5.0$, $SD = 3.16$). Tattoo artists were asked to report how long, on average, they spent in the actual tattoo process per tattoo. The minimum time reported was one hour while the maximum was five hours ($M = 3.70$, $SD = 1.64$). It was also reported that on average a minimum of five and a maximum of twelve tattoos were given by the artists ($M = 8.20$, $SD = 2.56$) in one week. Tattoo artists were asked to rate how experienced of an artist they considered themselves to be on a scale of 1 (I have very little experience) to 7 (I am very experienced). The minimum level of perceived experience reported was three while the maximum was five ($M = 4.50$, $SD = 1.00$).

Procedure

Participants were recruited via a sign-up sheet located at a local tattoo parlor; prior consent was obtained from the tattoo artists who wished to participate in the study. Materials used to recruit individuals explained that we are interested in how the process of getting a tattoo affects the mood and thinking of the person receiving the tattoo, the person giving the tattoo, and anyone who is there in a supporting role. It was also mentioned that past studies from the research team had examined people who received temporary piercings and that we were interested in seeing if tattoos showed similar effects.

Participants were directed to read an informed consent form and to provide their signature if they agree to participate. Included with the informed consent was a separate line for the participants to sign if they would like the option to have their responses recorded instead of writing them. Participants then completed a baseline survey, a practice Stroop, a baseline Stroop, and a baseline handgrip task. All participants were asked for verbal consent to repeat these measures once the tattoo process had proceeded for 30 minutes. If all participants gave consent to being interrupted, on or around 30 minutes (but not prior to 30 minutes) into the tattoo, participants completed a Stroop test, and handgrip task. Once the tattoo session has ended, participants provided a post-tattoo Stroop, handgrip task, and post-tattoo surveys.

Measures

Flow. The SHORT Flow State Scale (Jackson, Eklund, & Martin, 2010) was used to subjectively measure if any participants enter into flow. This is a 9-item scale (1 = *strongly disagree*, 2 = *disagree*, 3 = *neither agree nor disagree*, 4 = *agree*, 5 = *strongly agree*), with one item for each of the nine dimensions of flow: challenge-skill balance, action-awareness merging, clear goals, unambiguous feedback, concentration on the task at hand, a sense of control, loss of

self-consciousness, a sense of time transformation, and autotelic experience. Any responses marked as three or higher will be considered as having entered into that dimension of flow.

The Stroop test. The Stroop test (MacLeod, 1991) is a well-used measure where participants view a series of words (*red, blue, green, yellow, or xxxx*) printed in red, blue, green or yellow font color. Each combination is presented to the participant twice, creating a total of 40 trials. Participants are instructed to ignore the semantic meaning of the word and instead to focus on the color used for the font. As fast as possible, participants select their answer from buttons that indicate font color (labeled in black type *red, blue, green, and yellow*) that are displayed at the bottom of the screen. This task is easier to do when the color of the type matches the color of the word (e.g., the word red printed in red type) or “xxxx” printed in any color. It is more difficult to quickly evaluate words printed in a different color (e.g., the word red printed in blue). No feedback is provided to the participants regarding whether or not their answer is correct or incorrect and words are not repeated if an incorrect response is given. The primary outcome of the Stroop test is to calculate the speed at which participants respond to the incongruent trials (e.g., the word red printed in blue) compared to the control trials (e.g., the word red printed in red). Conducting this test on a tablet allows for a better assessment of the participant’s individual reaction times between the congruent and incongruent trials. The Stroop score consists of the differences between the latencies of the congruent and incongruent trials.

Handgrip Task. Designed to test ego depletion, the handgrip task requires participants to hold a handgrip in their non-dominant hand (Muraven, Tice, & Baumeister, 1998). A coffee sleeve was placed in between the handles. Participants squeeze the handles with the intent of keeping the coffee sleeve in place for as long as they can. Time was measured, in seconds, with a stopwatch. An upper time limit of five minutes was set for this task.

Surveys. Participants responded to two paper surveys, except for tattoo artists who also had a one-time demographic questionnaire (i.e. tattoo artists had three paper surveys). Contained within the baseline survey are demographic questions, the Inclusion of Other in Self Scale (IOS, Aron, Aron, & Smollan, 1992), and the Positive and Negative Affect Schedule (PANAS, Watson, Clark, & Tellegen, 1988). The post-tattoo survey includes the IOS, PANAS, the SHORT Flow State Scale (S FSS, Jackson, Eklund, & Martin, 2010), as well as questions regarding the individual's perception of the tattoo experience.

Results

Stroop

Participants partook in a Stroop task via tablet before and after the tattoo process. The Stroop task measures the difference in mean latencies between incongruent trials (the color of the font does not match the semantic meaning of the word displayed) and control trials (the color of the font matches the semantic meaning of the word displayed or 'xxxx' in any color). Refer to table 1 for the means and standard deviations for all measures. Stroop scores were analyzed using a repeated-measures ANOVA. No differences were found when comparing the pre and post scores, $F(1, 29) = 0.05, p = .83$. Time did not interact significantly with role, $F(2, 29) = 0.91, p = .41$. There were also no significant differences by role, $F(2, 29) = 2.05, p = .15$.

Flow

A 9-item SHORT Flow State Scale (Jackson, Eklund, & Martin, 2010) was used to measure states of flow. Participants answered on a 1 (*strongly disagree*) to 5 (*strongly agree*) scale. Results were analyzed using a one-way ANOVA. Contradictory to the hypothesis, no differences were found between the different roles in regards to entering into a state of flow (overall $M = 3.82, SD = 0.54$), $F(2, 21) = 1.90, p = .18$.

Self-report measures

A series of repeated-measures ANOVAs were conducted using the measures of positive and negative affect and the IOS. Positive affect decreased significantly from before to after the tattoo procedure, $F(1, 20) = 4.49, p = .05$. The role by time interaction was nonsignificant, $F(2, 20) = 0.96, p = .40$. The main effect of role was also found to be nonsignificant, $F(2, 20) = 0.85, p = .44$.

Negative affect also decreased slightly from before the tattoo to after although with trending significance, $F(1, 19) = 3.81, p = .07$. The role by time interaction was nonsignificant, $F(2, 19) = 1.01, p = .38$ as was the main effect of role, $F(2, 19) = 0.17, p = .89$.

Artists and clients reported significant increases in self-other overlap from before the tattoo to afterwards, $F(1, 16) = 6.86, p = .02$. There were no differences by role, $F(1, 16) = 0.03, p = .88$. No role by time interaction was found, $F(1, 16) = 0.68, p = .42$.

Clients and observers had no differences in self-other overlap from before the tattoo to afterwards, $F(1, 9) = 2.02, p = .19$. There was also no role by time interaction, $F(1, 9) = 0.02, p = .90$. No main effect of role was found, $F(1, 9) = 0.00, p = .95$.

No differences were found among the artists and observers concerning the main effect of time, $F(1, 7) = 2.07, p = .19$. There were also no differences found with a role by time interaction, $F(1, 7) = 2.07, p = .19$ or with the main effect of role, $F(1, 7) = 0.08, p = .79$.

Handgrip measures

Participants provided handgrip measures before and after the tattoo procedure in order to measure if ego depletion was occurring instead of an altered state of consciousness. Repeated-measures ANOVA was used to measure handgrip duration before and after the tattoo procedure. The amount of time that the participants squeezing the handgrip decreased significantly from

before the tattoo to after the tattoo, $F(1, 19) = 5.67, p = .03$. No role by time interaction was found, $F(2, 19) = 1.66, p = .22$. There was a significant main effect of role, $F(2, 19) = 8.13, p = .003$.

Discussion

Willingly receiving painful stimuli can elicit an altered state of consciousness known as transient hypofrontality while those who administer the painful stimuli may experience flow (Ambler et al., in press; Lee et al., in press). The purpose of this study was to gain insight into whether or not receiving a tattoo could create enough arousal to cause a person to enter into transient hypofrontality. This was indirectly measured with the aid of a Stroop task that participants completed on a tablet. Inconsistent with the hypothesis, no significant differences were found in Stroop scores. It is worth noting that, although nonsignificant, clients were the only group that showed an improvement in Stroop scores. All groups reported reaching a state of total flow however no significant differences were found. It may be necessary to use the 36-item measure of flow to gain a more accurate understanding of any differences between groups. Some of the items on the nine-item form (e.g. I had a feeling of total control over what I was doing, I had a strong sense of what I wanted to do) may have been too ambiguous when considering the different roles in this study. Artists may have responded lower than expected on some items (e.g. I was not worried about what others may have been thinking of me, the way time passed seemed to be different from normal) because their livelihood is dependent on clients being happy with the product and with staying within prior agreed upon time parameters. Anecdotally, because of a proclivity to easily lose track of time and to get lost in the moment, some artists reported that they will play well known movies or song playlists in order to stay well aware of how much time has passed.

A handgrip task was administered in order to test if participants were encountering ego depletion instead of transient hypofrontality. The amount of time that all participants persisted in the handgrip task decreased significantly from before the tattoo began to after the tattoo ended. The main effect of role also showed significance with artists exhibiting the longest persistence in the handgrip task. Of the five tattoo artists who participated, one reached the upper time limit of five minutes in the baseline measurement. All artists also reported fatigue in their non-dominant hand after the tattoo ended resulting from having to use both hands in the tattoo process.

The results from the Positive and Negative Affect Schedule and the Inclusion of Other in Self Scale were consistent with past research (Ambler et al., in press; Lee et al., in press; Klement et al., under review). Positive affect decreased from baseline to post tattoo while negative affect decreased with trending significance. At first glance a decline in both may seem odd. However, when some of the items used to measure affect are reexamined this finding makes better sense (e.g. interested and excited for positive affect, nervous and jittery for negative affect). Both artists and clients are likely to be feeling especially aroused at the anticipation of starting the tattoo. Once the tattoo is over, it makes sense that these feelings would be diminished. Artists and clients felt closer to each other when comparing from baseline to post tattoo while no other groups experienced differences in closeness.

Despite the pain, tattoos are anecdotally said to be addicting. Empirically observing the potential psychological and physiological responses may help to provide further insight into the appeal of tattoos. As is common with field studies, the sample size for this study was small. With this in mind, the present study should be considered as a pilot study or as the first of many similar studies. Due to the small sample size it is worth noting that one client had to stop the tattoo early because it became too painful. There was also an observer who left during the study

to receive their own tattoo. Having a larger sample size would help to negate results that may have potentially arisen from these anomalies. It is possible that future studies will be better able to parse out if the lack of significance concerning flow and transient hypofrontality was a Type II error. Future studies should also consider an alternative to the handgrip task for measuring ego depletion. Along with fatigue in the non-dominant hand for the tattoo artists there were also clients whose tattoo was on their non-dominant arm. It is possible that this had an impact on how long they were able to maintain the task after the tattoo procedure. Most of the studies conducted in this sample occurred in the evening, oftentimes lasting late into the night. It would behoove future studies to add variability into the time of the procedure in order to better capture if there are any diurnal variabilities.

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Table 1

Participant Means and Standard Deviations			
	Artist	Client	Observer
Variable	M (SD)	M (SD)	M (SD)
Total Flow	3.93 (0.41)	3.95 (0.63)	3.46 (0.25)
Stroop			
Baseline	90.09 (133.94)	162.21 (107.51)	187.83 (239.53)
Post	135.62 (129.16)	108.04 (89.28)	220.84 (156.63)
Positive PANAS			
Baseline	2.66 (1.17)	3.20 (0.80)	3.25 (1.03)
Post	2.40 (0.89)	2.99 (1.03)	2.43 (0.76)
Negative PANAS			
Baseline	1.46 (0.31)	1.27 (0.23)	1.32 (0.22)
Post	1.16 (0.26)	1.22 (0.42)	1.22 (0.32)
Baseline IOS			
Artist		2.20 (1.64)	1.75 (0.96)
Client	2.15 (1.46)		6.20 (1.79)
Observer	1.40 (0.55)	6.17 (1.17)	
Post IOS			
Artist		2.60 (2.30)	1.80 (0.84)
Client	2.92 (1.71)		6.40 (1.34)
Observer	1.75 (0.96)	6.33 (1.21)	
Handgrip			
Baseline	189.00 (113.44)	85.31 (37.39)	88.14 (64.48)
Post	135.62 (129.16)	108.04 (89.28)	220.84 (156.63)