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Religious coping and various religious practices have often been claimed to alleviate mental and physical suffering, but very little empirical evidence exists to support such arguments. The aim of the thesis was to investigate a possible pain modulation by religious beliefs and practices and to quantify potential psychological and physiological mechanisms that might mediate these experiences. The project included two related experimental pain studies in a laboratory setting and two related fieldwork studies during the Thaipusam Festival in Mauritius. The project thus integrates methods from standardised psychological testing, clinical psychophysiology, advanced neuroimaging, neuropharmacology, and classic ethnography. The project is the result of excellent interdisciplinary collaborations, bringing together leading experts from cognitive neuroscience, pain medicine, and the study of religion and culture.

In the experimental pain studies¹⁻², we showed that devout Protestants are able to reduce pain sensation and pain unpleasantness during prayer (see Figure 1). Our behavioural results indicate that expectations contribute to large amounts of the effect, but at a neuronal level we found robust decreases in BOLD in attentional and executive systems during prayer. Our findings therefore suggest that, in contrast to current knowledge of descending pain inhibition, prayer might attenuate pain through a reduction in processing of pain stimulus saliency and prefrontal control. As a religious coping strategy, prayer may in some circumstances allow devout subjects to cope with pain by dissociating from part of the negative input of the stimulus and hence decrease the demand for selecting the appropriate response. In addition, by using administration of the opioid antagonist Naloxone, our results suggest that the mechanisms involved rely on non-opioid systems.

The Thaipusam Festival in Mauritius is celebrated annually by Tamils and Hindus who engage in physical sacrifice in the form of ritual piercings, that are endured and carried through hours of ceremonial procession (see picture). Interestingly, we found that participants experience very low levels of pain sensation, both during the actual piercing and during the processions. Again, the use of prayer, expectations about pain, and strong religious beliefs contribute to the experience of pain. Moreover, our results indicate that Thaipusam participants experience symptoms of dissociation (e.g. amnesia, depersonalisation, and derealisation), which further helps participants to disconnect from the pain³.



Ritual piercing during the Thaipusam Festival in Mauritius. Photo: Jens Jegindø

The thesis also includes a brief introduction to cognitive pain modulation and discusses past research on pain modulation due to religious beliefs and practices as well as the possibilities and limitations of scientific methods one might apply to study these phenomena. The steps taken in this thesis therefore serve as important leads for further investigations of how cultural factors may influence the experience and modulation of pain.

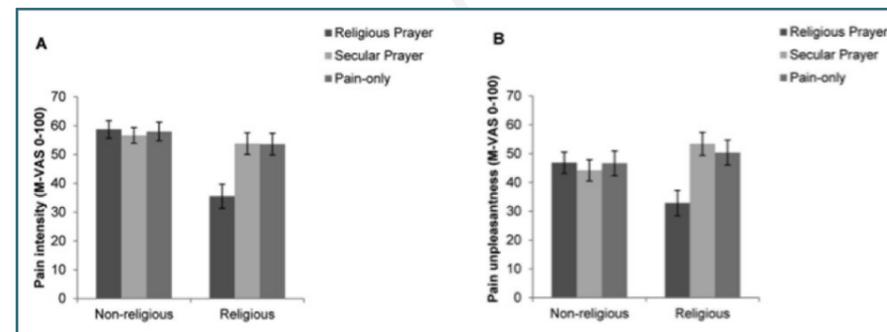


Figure 1 Mean ratings of pain intensity (a) and pain unpleasantness (b) for the non-religious and religious group during the three conditions, "Religious Prayer", "Secular Prayer", and "Pain-only". Religious participants reported a large and significant reduction in both pain intensity and pain unpleasantness¹.

References

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Uffe Schjødt and Armin W. Geertz

The Religion, Cognition and Culture Research Unit (RCC) at the Department of Culture and Society is a partner in MINDLab and CFIN. The goal of the RCC is to explore experimentally, empirically and theoretically the interactions between brain, body, culture and religion. Through the use of brain imaging, clinical tests, behavioral experiments and fieldwork both in Denmark and various parts of the world, we attempt to gain empirical insight in the workings of religious behavior and thought.

One of the focus areas of the RCC concerns prayer. We discovered very interesting features of prayer through brain imaging, clinical pain tests, and fieldwork in Spain and Mauritius. In contrast to popular neuro-theologians in the U.S., our point of departure is that there are no special areas of the brain dedicated to religious beliefs or behavior. We also assume that there is no generalized "religious experience"¹.

Uffe Schjødt showed in his brain scan experiments that even a simple procedure such as prayer draws on different areas of the brain. Using fMRI, he investigated how religious prayers changed the evoked BOLD response in a group of Danish Christians who are members of the Inner Mission². Like other forms of repeated habits, we hypothesized that praying would activate the striatal reward system. Within the striatum, a main effect was found in the caudate nucleus of the dorsal striatum. The activation of the caudate nucleus supports the hypothesis that prayer may stimulate the dopaminergic system.

In a second study, Schjødt et al.³ investigated the differences between formalized and improvised forms of prayer, in other words, the Lord's Prayer in contrast to personal prayers to God. It was hypothesized that improvised prayers consisting of conversations with God would activate social cognition and

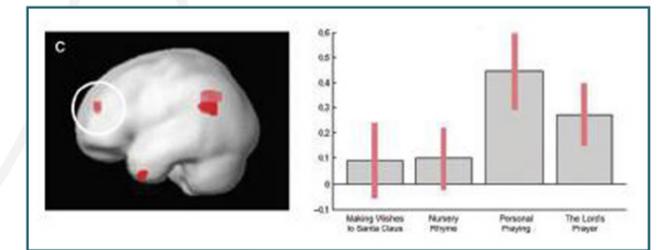


Figure 1 Left: Personal praying relative to making wishes to Santa Claus. Right: Effect size analysis of the regions of interest in the four conditions relative to baseline (90% CI). Anterior medial prefrontal cortex.

its neural substrates, i.e. areas associated with theory of mind processing (anterior medial prefrontal cortex, the temporopolar region, and the temporo-parietal junction)⁴. It was further hypothesized that these areas were less active in formalized prayers such as the Lord's Prayer as well as in conversations with another invisible interlocutor which participants did not believe to be real (Santa Claus). The results supported these hypotheses (Figure 1).

In a third study, Schjødt et al.⁵ investigated how assumptions about speakers' abilities changed the evoked BOLD response in secular and Christian participants who received intercessory prayer. Christian recipients who assumed that the speaker was charismatic down-regulated areas in the medial and the dorsolateral prefrontal cortex bilaterally in response to the intercessory prayer. This down-regulation correlated with participants' subsequent ratings of the speakers' charisma and the experience of God's presence during prayer (Figure 2).

References

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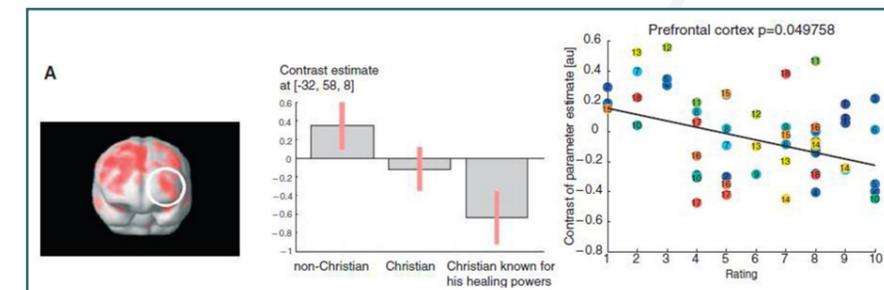


Figure 2 Left: Activations in 'non-Christian' relative to 'Christian known for his healing powers'. (A) prefrontal cortex. Middle: Effect size of the three conditions compared to baseline. Right: Effect of listening to the praying speakers (y-axis) as a function of subsequent ratings of the speaker's charisma on a scale from 1-10 (x-axis). A one-sample t-test across subject-specific slopes showed a significant effect for all regions except for the cerebellum ($P < 0.05$).