# 'Empathy and Judging Other's Pain; an fMRI study of Alexithymia.' A Critical Review

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## Abstract

This essay shall critically review the experimental paper 'Empathy and Judging Other's Pain; an fMRI study of Alexithymia,' written by Y. Moriguchi, J. Decety, T. Ohnishi, M. Maeda, T. Mori, K. Nemoto, H. Matsuda and G. Komaki (2007). It is of primary importance to acknowledge that this review shall discuss Alexithymia (ALEX) and empathy in accordance with the definitions given by Moriguchi et al. (2007). ALEX can thus be understood as a: 'difficulty in identifying and expressing one's own emotional states,' whilst empathy can be understood as, 'a naturally occurring subjective experience [referring to] the ability to identify with and vicariously share the thoughts and feelings of others' (Moriguchi et al., 2007, p.2223).

**Keywords:** Review, Alex, empathy.

## Essay

Moriguchi et al. propose that the problems with emotional processing experienced in ALEX are suggestive of a possible impairment in empathic skills, as the ability to identify one's own emotional states is widely accepted as a prerequisite for identifying emotional states in others (Decety & Jackson, 2004). To test this hypothesis two groups of participants were recruited for comparison; an ALEX group (n=16) and a non-alexithymia (non-ALEX) group (n=14). Functional magnetic resonance imaging (fMRI) was used with all participants, to observe and compare the brain's regional hemodynamic responses to the visual perception of pain, after witnessing images of human hands and feet in painful situations. Additionally, participants were asked to assign a subjective pain-rating to each image, which alongside empathy-related scores were then compared between

groups and against the fMRI data as assessment for empathic ability. It was found that areas of the brain traditionally associated with pain recognition and empathy showed normal levels of activation in the non-ALEX group but abnormally low levels of activation in the ALEX group. This was found to concur with data from the rating tasks as the ALEX group rated the pictures as less painful than the non-ALEX group, whilst obtaining lower scores on measures of mature empathy. Accordingly, Moriguchi et al. concluded that ALEX individuals experience cognitive impairments in emotional processing of other's pain, indicative of the importance of self-awareness in empathic ability (Moriguchi et al, 2007).

This essay shall review the paper presented by Moriguchi et al., critically considering the methodologies, results, conclusions and any unresolved issues with consideration of the literature presented. It is, however, important to note that there are many possible avenues for discussion within each of those named areas, but given the scope of this essay only the issues considered to be imperative shall be attended to. Furthermore it must be identified that this research focuses on the characteristics of a particular deficit, therefore a discussion of alternative behavioural experiments with healthy subjects shall not be addressed, because healthy subjects do not express the characteristics of ALEX. The critique shall progress chronologically in accordance with the issues presented in the original paper.

First and foremost, Moriguchi et al. present an overview of relevant literature highlighting the context, significance and rational of their research. They discuss theoretical propositions for a model of empathy whereby the perception of emotion is said to activate the same neurological mechanisms as the experience of emotion (Preston & de Waal, 2002). In support, they offer an overview of findings from several fMRI studies demonstrating shared neurological mechanisms for empathy and subjective experience (Singer, Seymour, O'Doherty, Kaube, Dolan and Frith, 2004). Alongside a lack of research into empathic ability in ALEX this discussion therefore explains the motivation for their research.

However, the presentation of literature in relation to the present understanding of ALEX implicitly suggests that empathic ability is dependent on an initial development of self awareness. This is perhaps a simplistic framework for a complex phenomenon as some theorists propose that infants learn about their own emotions from identifying emotional states in others (Keenan, 2002). Such theory implies a counter-directional explanation of the relationship between empathy and emotion

that is not acknowledged by Moriguchi et al. As a result, a more holistic discussion of empathy with an emphasis on the mutual dependence between empathy and self-awareness would have given a stronger rationale for the research and added significance to these findings that other research may lack.

Nevertheless, the literature presented identifies the neural networks thought to underpin the experience of empathy, which provides an explanation for the use of fMRI. In order to assess empathic ability in ALEX, it could have been possible to conduct this study using either fMRI or a stand-alone comparison of the ratings and psychological scores. However, using both fMRI and subjective rating data allowed for a physiological observation of the extent of empathic ability, as well as a measurement of the conscious awareness of empathy. Thus, the combination of the objective and subjective methodologies subserve each other to provide a comprehensive explanation of the extent of empathic ability in ALEX.

Nonetheless, fMRI can only identify blood flow to the brain, which, although indicative of brain activity, does not provide information about neuronal functioning (Watson, 2011). Therefore, the Moriguchi et al. paper suggests that ALEX individuals have reduced activity in the areas of the brain associated with recognising pain and empathy, but does not comment on the specifics of this activity at a neuronal level. Additionally, it seems that Moriguchi et al. have not considered all possible explanations for the symptoms of ALEX.

In 'The chameleon effect' - whereby empathic, in comparison to less empathic, individuals display a nonconscious mimicry of posture - facial expression and gestures of others has initiated discussion to suggest that inner imitation of actions may underpin the emergence of empathic abilities (Carr, Iacoboni, Dubeau, Mazziotta and Lenzi, 2003). Furthermore, Meltzoff & Moore (1997) offer an 'active intermodal mapping theory' of imitation that suggests there is an innate, domain specific mechanism for imitating humans, allowing infants to begin learning about their environment from birth. Therefore, perhaps recognising one's own emotions develops from the ability to identify characteristic traits of emotional states in others and integrate them into a unified understanding of different sets of emotions. If this system is deficient from birth, a variety of difficulties with emotional and social understanding could develop, including those experienced in ALEX.

**'Empathy and Judging Other's Pain; an fMRI study of Alexithymia.' A Critical Review**

Recent research has suggested that mirror neuron activity underpins a variety of social skills within humans, inclusive of imitation and empathic ability, as it is proposed that a physiological observation/execution system may facilitate social understanding (Oberman, Pineda and Ramachandran, 2007). As frequency (8-13Hz) over the sensorimotor cortex is thought to reflect mirror neuron activity (Oberman, Hubbard, McCleery, Altschuler, Ramachandran and Pineda, 2005), EEG recordings of a neonates response to actual and observed movement in comparison to a non-observed stimulus, could offer evidence for or against early imitation mechanisms depending on the prevalence of mirror neuron activity. If this is found, the causal relationship between difficulties in recognising one's own emotions, and the empathic difficulties apparently prevalent in ALEX, would be less readily assumable.

Moriguchi et al. overlook the role of deficient mirror neuron activity as a potential explanation for the empathic impairments experienced in ALEX, with no reference to this possibility and no acknowledgement to the importance of mirror neurons in empathic skills. Consequently, their study offers a rudimentary explanation of the neurological systems accountable for the possible empathic impairments observed in ALEX.

Mirror neurons have been studied using transcranial magnetic stimulation (TMS), a non-invasive method of observing specific neuronal activity (Maeda, **Mazziotta** and **Iacoboni,** 2002). Consequently, TMS could be a possible alternative method for further investigation into whether ALEX individuals experience a difference in empathy-related mirror neuron activity compared to non-ALEX individuals.

Additionally, electrical activity in the sensorimotor cortex has been linked to the mirror neuron system. Therefore electroencephalogram (EEG) recordings of the sensorimotor cortex have been used to investigate the possibility of deficient mirror neuron activity in populations who express difficulty in understanding the behaviour of others (Oberman et al., 2005). Consequently, in comparison to using fMRI, perhaps a combined EEG and TMS study could more adequately assess the empathic abilities in ALEX, allowing for observation before and after direct manipulation of the cortical regions associated with empathy.

The pictures of human hands and feet in painful situations may also be a weak methodological tool for assessing empathic abilities in ALEX. Whilst Moriguchi et al. acknowledge that these images

may not account for the entire construct of empathy they neglect the extent of this and the possible impact on their findings.

In the introduction Moriguchi et al. outline three components of empathy; affective, cognitive and regulatory. In line with this, the definition of empathy they offer is relative to the emotions and cognitions of other humans. The pictures presented as a stimulus for empathy however did not relate to any emotional pain such as social rejection or bereavement and offered limited capacity for cognitive pain due to a lack of perspective-taking opportunity in the weak representation of human suffering. It could be argued that the cognitive inference of physical pain into thoughts and feelings accounts for the assessment of empathy but ultimately, by presenting isolated limbs the images were dehumanised, whilst the depictions of these limbs were poor in accounting for the entire construct of empathy. Inferentially, these measures for empathy do not explicitly concur with the definition of empathy given. Thus, it could be possible that the images measured an understanding of pain levels and not empathic ability. The evaluations may be confounded further by the individual's subjective pain threshold, as mentioned briefly in the discussion. Subsequently, perhaps ALEX individuals in this study had impairments in pain judgement rather than empathy.

Considering this, it may be of methodological significance to offer a more multi-dimensional representation of pain through the use of video or story telling techniques where the participant's witness human plight first hand. Moreover, adding an explicit emotional component to the empathy stimuli such as forlorn facial expressions or crying, may better represent an opportunity for empathy.

Nevertheless, results derived from this study appear to be accurate as they are supported by findings from other studies. For example, a meta-analysis of research regarding the neural networks of pain and empathy found that common brain structures involved in subjective pain and empathy included the left dorsolateral prefrontal cortex (DLPFC), the dorsal pons, the cerebellum, and the left caudal anterior cingulate cortex (ACC) (Lamm, Decety and Singer, 2010). In concordance, Moriguchi et al.'s fMRI data revealed that non-ALEX individuals showed expected levels of functioning in these areas whilst ALEX individuals showed hypofunction. Tables and images were provided to enhance understanding of the written explanation of results, including an outline of appropriate statistical measures used (Worsley, Liao, Aston, Petre, Duncan, Morales and Evans,

2002), which was very useful. Nevertheless, a pictorial demonstration of the comparison of pain ratings between the groups would have been more easily accessible than the table format presented.

Overall, Moriguchi et al. concluded that ALEX individuals have impairments in empathic ability which emphasises the importance of self-awareness in the identification of emotional states in others. One of their main justifications for this claim is the observation of hypofunction in the ACC, which is considered to be important in emotional awareness (Moriguchi et al., 2007). However, as ALEX individuals report emotional processing difficulties rather than an emotional processing deficit, it could be possible that even with low activation of the ACC there may be some preserved empathic ability, perhaps predominantly driven by the existence of more primitive, unconscious empathic pathways.

It has been proposed that the ACC is a relatively new structure of the cortex in terms of evolution as it contains neuronal formations specific to humans and apes (Allman, Hakeem, Erwin, Nimchinsky and Hof, 2002). If this is true, alongside the ACC being integral for empathy, then it should be expected that only humans and apes will show signs of empathic behaviour. However, evidence for empathic ability in other animals has been implied from the observation of behaviours such as flocking, mobbing and schooling (Allot, 1992). Furthermore, it is suggested that empathic signalling between members of a species allows for survival related behaviours to transpire (Ibid.). Therefore, animals appear to empathise with each other on a more basic level in order to increase their evolutionary fitness. This suggests that there are other possible neuronal pathways, perhaps dependant on emotional processing in the amygdala, which account for empathy without it transpiring as a conscious phenomenon. As a result, it may be possible that ALEX individuals possess an ability to empathise but only on a primitive, unconscious level, indicating that self-awareness is possibly not as integral to the empathic process as Moriguchi et al. suggest. Additionally, this may imply that the ability to empathise precedes the development of self awareness, as self-awareness in animals is yet to be defined (Ibid.).

In order to test this, fMRI and behavioural observations would have to be conducted to assess if ALEX individuals can interact using empathic judgement, whilst monitoring the neurological mechanisms underlying the behaviour. For example, very simplistically, two objects (A and B) that are completely identical in nature could be presented. The ALEX individual would observe someone giving a pain response after touching object A and then has to decide which object to take

for themselves. If after rating the stimuli as neutral they opt for object B, it could be inferred that they have made a choice based on primitive empathy. Nevertheless, these suggestions are speculative, with no empirical research supporting them. Given the vast amount of literature concurring with Moriguchi et al. it is possible to say that the fundamentals of their conclusions are largely convincing.

This essay has critically reviewed the experimental paper by Moriguchi et al. (2007), considering the methodologies, results and conclusions in relation to the literature presented as well as other research. Overall, it can be said that the study drew upon relevant literature in favour of the research but somewhat lacked any insight that may have countered their position. Even so, it appears that the methodologies used, despite some possible alternatives, were accurately selected and the results drawn were carefully analysed whilst on the whole, appropriately depicted. As a result, the conclusions drawn were at most convincing, although there is room for speculation and avenues for further research. Thus, holistically the paper does provide a good basis for the understanding of ALEX characteristics and offers new, significant findings to suggest that ALEX individuals have an impairment of conscious empathic ability.

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**'Empathy and Judging Other's Pain; an fMRI study of Alexithymia.' A Critical Review**

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