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# EMPATHY AND ETHNICITY:
## The Ethnic Empathy Bias

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**Empathy and Ethnicity: The Ethnic Empathy Bias**

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I hereby certify that all material in this final year project which is not my own work has been identified and that no work is included for which a degree has already been conferred on me.

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**Abstract**

The aim of this thesis is to overview studies examining the effect ethnicity has on the neural and physiological responses associated with empathy and the underlying mechanisms behind this effect. It has been revealed that ethnicity can modulate the empathic responses in that faster physiological arousal and greater sensorimotor resonance occurs during the perception of own ethnic members in suffering. A reduction and even total absence of activity in empathy-associated brain regions such as anterior cingulate cortex, anterior insula, temporo partial junction and medial prefrontal cortex has further been seen during the perception of other ethnic members in pain. There have however been studies where ethnicity has not had an effect on empathic responses, indicating that it might not be ethnicity per se but instead other underlying mechanisms that causes the difference in empathic responses. There is an ongoing debate on which these mechanisms might be. It has been suggested that it might be attitudes, similarity and familiarity with the target, general ingroup bias, differences in perceptual processes and culture. The thesis will end with a discussion on how the results can be interpreted, the implications of the results, proposals for future research directions and a conclusion.

Keywords: ethnicity, empathy, pain, ACC, AI, culture, attitudes

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## 1. Introduction

Empathy is the capacity to understand and share the emotional states of others and is the mechanism that underlies and facilitates social understanding and cooperation (Decety & Jackson; 2004; Singer & Lamm, 2009). It t has been seen to be important for phenomena such as helping, morality, altruism and justice (Batson et al., 1997). If people fail regarding the sharing of the emotional states of others it can lead to a reduction in the responsiveness to the person's needs, which can result in a decrease in the probability of providing help or even to understand that support is needed (Batson et al., 1997, Forgiarini, Gallucci & Maravita, 2011).

Recent neuroimaging research has resulted in an increased interest in the neural mechanisms underlying empathy. Research has been carried out demonstrating that the perception of others in pain activates some of the same brain regions that are activated during the first-hand experience of pain, which indicates an overlap in neural responses to self-experienced pain and pain of other people (Engen & Singer, 2013; Singer & Lamm, 2009). Furthermore, research in this field has found that instead of demonstrating equal neural responses to another person's emotional experiences, people's neural responses differ, depending on various factors (Hein & Singer, 2008; Bernhardt & Singer; 2012). It has been found that ethnicity can be one of these factors (Avenanti, Sirigu & Aglioti, 2010; Contreas-Huerta, Baker, Reynolds, Batalha & Cunnington, 2013; Forgiarini et al., 2011; Mathur, Harada, Lipke & Chiao, 2010; Xu, Zuo, Wang & Han, 2009).

Many definitions of ethnicity have been proposed, but there is no consensus as to the best or most appropriate ones. In general it can be defined as a concept that defines groups of people based on characteristics such as for example shared culture, language, beliefs, behaviours, history and experience (Anderson, Green, & Payne, 2009). It represents a strong salient cue to group membership and some of the common perceptual cues that are used to distinguish different ethnic members are for example skin colour and hair texture. (Kubota, Banaji, & Phelps, 2012; Forgiarini et al., 2011). It has been shown that the

registration of ethnicity in individuals occurs rapidly and with a high degree of automaticity (Ito & Senholzi, 2013; Kubota et al., 2012). Furthermore, it has been revealed that this special attention to ethnicity occurs even in the absence of any explicitly directed attention towards ethnic features (Cosmides, Tooby & Kurzban, 2003). Lastly, these mechanisms are associated with many ethnicity biased behaviors (Ito et al., 2013). There is a growing interest in the effect ethnicity has on the physiological and neural empathic responses and a various of studies have been carried out studying this phenomenon (Avenanti et al., 2010, Contreas-Huerta et al., 2013; Forgiarini, et al., 2011; Mathur et al., 2010; Xu et al., 2009). Many of the results of these studies have revealed that a difference in empathic response to same ethnic members (SEM) and to other ethnic members (OEM) exists in that people seem to have a tendency to show less empathic responses to OEM, something that in this thesis will be referred to as the ethnic empathy bias (EEB). This has for example been seen in the clinical pain treatment in America where persons with black skin-colour more frequently have received inadequate treatment compared to Caucasians (Todd, Deaton, D'Adamo & Goe, 2000). The word Caucasian refers in this context to persons with white skin-colour. Furthermore people have given OEM longer court sentences (Johnson, Simmons, Jordan, MacLean, Taddei &Thomas, 2002). There is other situations where the ability to recognize the suffering in others is of great importance. Examples of these are in the police interventions, policy making, rescuing operations and circumstances where physical force and punishments are present (Forgiarini et al., 2011). Interventions to reduce this bias are made, but to make them effective it is of great importance to know how to address the problem, if not, they become ineffective or can even have a reverse effect (Batson et al., 1997).

Empathy is a complex phenomenon and there are several factors that can cause this EEB. It might be that it is ethnicity per se that causes the bias, or it might be other mechanisms that have been seen to have an effect on empathic response. One way of

addressing this issue is to look at differences in empathic responses on a neural and physiological level. It is a quite new but growing field that provides important cues regarding how and why differences in empathic responses occur between the perception of SEM and OEM in suffering.

The aim of this thesis is to search for answers to the two following questions;

1. In what way do the physiological and neural empathic responses differ between the perception of SEM and OEM in suffering?
2. What are the underlying mechanisms behind the EEB? Is it really ethnicity per se or can the explanation be searched for elsewhere?

To answer these questions an overview of the research field that examines the EEB will be carried out and presented. For a better comprehension of the content of these studies relevant background information will be provided before the presentation of the studies. First there will be a section that provides information about the concept of empathy. There will be an overview of the different components that are suggested to be involved in an empathic response, some of the most important brain regions that are involved in empathy and a short overview of the factors that can modulate an empathic response will further be presented. After that a section will follow about neural correlates that have seen to frequently be associated with ethnicity, as to make the reader get a greater comprehension in to what extent ethnicity can affect neural responses. In the research field about ethnicity and empathy there has been a variety of different measurements that have been used which will presented and after that follows the section that provides an overview of studies in this field. In the end there will be a brief summary and a discussion regarding the findings that so far has been made concerning the effect ethnicity has on the empathic neural correlates. Interpretations and implications of the results will be provided as well as

limitations of the studies, why they are important, suggestions for future directions in this research field and the thesis will then end with a conclusion.

# 2. Empathy

## 2.1. Defining empathy

It has been suggested that an empathic response occurs if the following criteria are present;, “i) one is in an affective state; (ii) this state is isomorphic to another person's affective state; (iii) this state is elicited by the observation or imagination of another person's affective state; (iv) one knows that the other person is the source of one's own affective state” (de Vignemont & Singer, 2006). However, no definite definition of empathy exists but instead there are different concepts that have been suggested to be associated or at least play a part in the empathic response. A short introduction of some of the most frequently mentioned concepts will now follow so as to get an understanding of the confusion that easily can occur regarding empathy and the importance to clarify exactly what one refers to when talking about empathy. The concepts that now will be introduced are mimicry, contagion, perspective-taking, theory of mind and perception-action coupling.

### 2.1.1. Emotional contagion.

Emotional contagion is defined as the tendency to “catch” other people's emotions (Hatfield, Cacioppo, & Rapson, 1993; Shamay-Tsoory, 2011; Singer & Lamm, 2009) and has also been referred to as “primitive empathy” (Shamay-Tsoory, 2011).It’s a process that is related to but distinct from empathy. It has been proposed that it’s the mechanism underlying babies tendency to start crying when they hear other babies crying even though they yet haven’t developed a sense of a self-distinction from others (Decety, 2011).

### 2.1.2. Mimicry.

Mimicry is defined as the tendency to automatically synchronize affective expressions, vocalizations, postures, and movements with those they are interacting with (Neumann & Westbury, 2011; Singer & Lamm, 2009) and has been proposed to underlie emotional contagion (Shamay-Tsoory, 2011).

Many researchers currently consider motor mimicry as crucial to emotional empathy and that it's also possibly biologically 'hardwired' (Hatfield et al., 1994; Preston and de Waal, 2002; Singer & Lamm, 2009).

On a conceptual level, neither emotional contagion nor mimicry can account for the full-blown experience of empathy. However, there are situations where mimicry occurs without an emotional component and other situations where emotions are automatically elicited by observing others' emotional states in the absence of any involvement of motor mimicry (Singer & Lamm, 2009). Therefore mimicry and emotional contagion are seen as important, but still distinct and neither necessary nor sufficient processes for the experience of empathy. Furthermore, although these concepts each refer to a different phenomenon, they usually occur in concert. For example, in most cases, mimicry or emotional contagion precedes empathy (Singer & Lamm, 2009).

#### 2.1.3. Perspective-taking.

Perspective-taking means to take over the mental perspective of the observed other which makes it possible to infer what a person currently believes about the world, given their point of view (Engen & Singer, 2013).The human brain seems to have a unique ability to represent the mental states of the self and others and furthermore the relationship between these mental states (Singer & Lamm, 2009).

#### 2.1.4. ToM.

ToM refers to the unique ability to represent and interpret the mental states of others which is crucial for social understanding and communication (Engen & Singer, 2013; Singer & Lamm, 2009). However, Engen & Singer (2013) distinguishes ToM perspective-taking from a full-blown experience of empathy by arguing that even though both relies on networks associated with making inferences regarding mental states of others, empathic responding requires the additional recruitment of networks involved in emotional processing.

### 2.1.5. Perception-action coupling.

Preston & de Waal (2002) proposed a neuroscientific model of empathy, which they named the perception-action model. According to the perception–action model empathy is based on neural simulation, which means that the perception of a certain behavior or emotion in another individual activates one's own neural representations of the same behavior or emotion (Decety & Jackson, 2004; de Vignemont & Singer, 2006; Preston & de Waal, 2002). It's proposed that the perception of a person's state activates the perceivers corresponding representations, and this will result in a simulation of the perceived person's corresponding sensorimotor, affective and/or mental state. Based on this assumption, perception–action coupling is essential for a number of forms of interpersonal sensitivity, such as emotional contagion, empathy, perspective taking and action understanding (Decety & Jackson, 2004; Preston & de Waal, 2002). The system of neurons building these shared networks are often referred to as the "mirror-neuron-system" which is a term that refers to a system consisting of neurons that fire both when the individual performs a certain action and when they observe someone perform the same action (Rizzolatti & Craighero, 2004).

### 2.1.6. The hypothesis of shared-network.

The hypothesis of shared-network is an influential hypothesis that today guides empathy research. It states that empathic experiences are based on the activation of the same neural networks that are activated in the first-person experience of an affective state (Engen & Singer, 2013; Preston & de Waal, 2002).

## 2.2. Brain regions involved in empathy

Research indicates that empathy is a multi-component process that is supported by brain regions involved in both affective and cognitive processes (Bernhardt & Singer, 2012; Decety & Jackson, 2004, Walter, 2012). The neural circuits underlying different forms of empathy do overlap but also involve rather specific brain areas (Bernhardt & Singer, 2012;

Decety & Jackson 2004; Walter, 2012). Some of the most important of these areas will be presented in this section. These areas are the somatosensory cortex, anterior insula (AI), anterior cingulate cortex (ACC), inferior frontal gyrus (IFG), medial prefrontal cortex (MPFC), temporal partial junction (TPJ) and superior temporal sulcus (STS).

### 2.2.1. Brain regions involved in the affective components.

#### *2.2.1.1. Somatosensory cortex.*

The somatosensory cortex is thought to encode the more sensory-discriminative components of pain and is involved in both first-hand and third-hand experience of sensory stimulations such as touch (Avenanti, Bueti, Gaspare, Galati & AgliotI, 2005; Gazzaniga, Ivry & Mangun, 2002). It has been revealed that our ability to recognize other people's emotion is significantly diminished when the somatosensory cortex is damaged (Adolphs, Damasio, Tranel, Cooper, & Damasio, 2000).

#### *2.2.1.2. AI.*

Connectivity and functional data support that the AI plays an important integrative role in sensation, affect, and cognition and has commonly been observed in the processing of pain (Bernhardt & Singer, 2012; Shamay-Tsoory, 2011). It's involved in the mapping of internal bodily states and in the representation of emotional arousal and feelings (Critchley, 2005). In particular, activity in the AI is believed to be the final product of the integration of physiological signals with motivational and social conditions represented in other parts of the brain. In other words, the AI is most likely the brain region that reflects the subjective feeling state associated with the vicarious experience of pain (Bernardt & Singer, 2009; Engen & Singer, 2013). This region has furthermore been associated with a range of different affect related functions such as the evaluation and experience of emotion (Gazzaniga et al., 2002).

#### *2.2.1.3. ACC.*

The ACC is the area that has most frequently been linked to the experience of pain (Bernhardt & Singer, 2012). It seems to be involved in the emotional reaction to pain rather than to the perception of pain itself. It has also been associated in several of different cognitive functions such as reward anticipation, decision-making and impulse control (Gazzaniga et al., 2002). It is furthermore strongly connected to the AI and has been suggested to play an important role in the integration of pain, negative affect, and cognitive control (Benuzzi, Lui, Duzzi, Nichelli & Porro, 2009). ACC is a sub region within the cingulate cortex which is divided into at least four different sub regions; ACC, medial cingulate cortex (MCC), posterior cingulate cortex (PCC) and retrosplenial cortex which differ in their connections with other brain areas (Bernhardt & Singer, 2013).

ACC and AI has been regarded as the key regions in empathic responses and it has recently been suggested that whereas the AI is an input region of a system based on self-awareness, the global feeling states are ultimately represented in ACC where control, selection and preparations of appropriate responses can be carried out (Bernhardt & Singer, 2012).

#### *2.2.1.4. IFG.*

This region has been associated with emotional recognition, and has been suggested to play a key role in empathy (Engen & Singer, 2013). It seems to play an important role in emotion regulation strategies that involves the active generation of alternate appraisals of emotionally salient stimuli (Engen & Singer, 2013). It has also been demonstrated that this region has been activated during both imitation and passive viewing of emotional faces (Shamay-tsoory & Peretz, 2009).

### 2.2.2. Brain regions involved in the cognitive components.

#### *2.2.2.1. MPFC.*

The MPFC has been described as a center for social information processing and it plays an important role in perspective-taking abilities (Volz, Kessler & von Cramon,. 2009; Ward, 2012). The MPFC can be divided into the dorsal part (dMPFC) and the ventral part (vMPFC) (Decety, 2011; Gazzaniga et al., 2002). The dMPFC is involved in abstract social reasoning and is suggested to be a core region when it comes to judging the preferences of others (Volz et al., 2009). The vMPFC on the other hand has been suggested to play a key role in self-awareness (Winecoff, Clithero, Carter, Bergman, Wang, & Huettel, 2013).It has furthermore been suggested that the vMPFC stores information about the emotional valence of an action and that reward value signals in the vMPFC can be increased through emotion regulation processes (Winecoff et al. 2013).

#### *2.2.2.2. TPJ.*

TPJ has been found to be a crucial component in empathy, particularly when it comes to the ability to judge the intentions and beliefs of others (Ward, 2012). It has been suggested that TPJ is a key structure for the conscious experience of the "normal self", in that it mediates spatial unity of self and body, and it is further proposed that damage in the TPJ can lead to out-of-body experiences (OBEs), which is an experience when a person seems to perceive the world from a location outside of his physical body. Stimulation of the TPJ can give people experiences that someone else is present, when the reality is that the persons are alone (Arzy, Seeck, Ortigue, Spinelli & Blanke, 2006). These findings suggest the TJP is involved in both self-monitoring and monitoring of others and it is furthermore proposed that it might be involved in non-social functions too, such as attention- switching (Decety & Lamm, 2007).

#### *2.2.2.3. STS.*

This region has been hypothesized to be involved in the representations of perceived intentional actions and in the processing of the relationship between an observed motion and

the structure of the surrounding environment (Saxe, Xiao, Kovacs, Perrett, & Kanwisher, 2004).

Damage to the STS has been seen to result in disruption of a person's ability to judge where someone else is looking (Campbell et al, 1990). This is an ability that has been proposed to be important in social understanding and communication, since information about a person's gaze can reveal cues about their feeling states towards the observed object (Saxe, Xiao, Kovacs, Perrett, & Kanwisher, 2004).

### 2.3. Factors influencing empathy

It has been proposed that there exist two types of modulation of empathy. First of all, one can modulate one's empathic response in a voluntarily way by using the control one has over one's emotional responses (de Vignemont & Singer, 2006). This has for example been seen in medical practitioners who can acquire high degrees of emotional control by experience and practice (Cheng et al., 2007). Secondly, empathy can be modulated by implicit (unconscious) appraisal processes, which strongly can influence the degree of empathic responses. These implicit processes can be modulated by various factors, such as the features of the empathic emotion (e.g., intensity, saliency, and valence), features of the empathizer (e.g., gender, personality, and mood), the relationship between empathizer and target (e.g., familiarity, affective link, and valuation of the other) (Engen & Singer, 2013; de Vignemont & Singer, 2006).

## 3. Ethnicity

### 3.1. Brain regions involved in the processing of ethnicity

As mentioned in the introduction ethnicity has been seen to have an effect on various brain regions, not just those involved in empathic neural and physiological processes. The brain regions that have been most commonly associated with ethnicity are the amygdala, fusiform face area (FFA), ACC and dorsolateral prefrontal cortex (dLPFC). A short overview

of these will be provided in this section so as to get a deeper understanding of in which ways ethnicity can affect the neural processes. The section will end with a short description of a hierarchy control model that provides a suggestion on in which stages of the processing of ethnicity each of these brain regions are activated.

### 3.1.1. Amygdala.

The amygdala is the brain region that is most frequently implicated in studies of ethnicity (Kubota et al., 2012). It is a brain region that has been linked to emotional learning, especially with the learning of the emotion fear (Gazzaniga et al., 2002, Phelps et al., 2000, Ward, 2012). It is furthermore involved with detection of emotional valence information, once again, especially with fear, but it has also been linked to positive emotions (Ward, 2012). Increased activity in this area has been seen during perception of other-ethnicity-individuals (Kubota, Banaji, & Phelps, 2012). This activation has especially occurred during perceptual encoding of faces, which has been suggested to indicate an involvement of the amygdala when it comes to the detection of ethnicity stimuli (Kubota et al., 2012).

### 3.1.2. FFA.

This is a region found in the visual cortex that is specialized in the processing of faces (Gazzaniga et al., 2002). It has been seen that the perception of faces are sensitive to ethnicity (Young, Hugenberg, Bernstein, & Sacco, 2012). It seems that even basic aspects of face perception are modulated by ethnicity and this effect occurs in a fast and probably automatic way (Adams et al., 2010). Furthermore, it has been seen that people recognize faces of others sharing their ethnicity, faster and in a more accurate way compared to faces of persons with another ethnicity, something that is referred to as the other-race-effect (ORE) (Adams et al, 2010; Young et al., 2012).

### 3.1.3. ACC.

It is suggested that ACC aids the engagement of executive control when a conflict is detected (Barch, 2001; Gazzaniga et al., 2002). Studies have revealed that people often try to control the negative ethnicity-based behaviours caused by the automatic negative evaluations (Kubota et al., 2012). It has further been shown that there is a positive correlation between a person's amount of implicit attitudes regarding ethnical bias and activation in ACC (Kubota et al., 2012). It is suggested that this correlation indicates that the stronger the automatic negative responses are to OEM the more effort is needed to control this bias, hence an increase in ACC is seen (Kubota et al., 2012).

(For more information about the functions of ACC, se section "Brain regions involved in the affective components".

#### 3.1.4. dLPFC.

Activity in dLPFC is frequently seen in ethnicity studies where increased activation in ACC is present (Kubota et al., 2012). Whereas ACC is associated with performance and conflict monitoring dLPFC is linked to top-down executive control of performance (MacDonald, Cohen, Stenger & Carter, 2000). Hence, it is suggested that in situations where conscious intentions to behave in non-prejudice behaviors is desired but, implicit attitudes are present, ACC detects this conflict and dLPFC activates, so that the undesired implicit racial associations can be regulated (Kubota et al., 2012). However, it has been suggested that ethnicity-biased behaviors can occur even though these conflict-and-control-regions are activated (Amodio et al., 2004).

### 3.2. A hierarchical control model

Kubota et al., (2012) describe a model that exists in the social psychological literature concerning the processing of ethnicity. According to this model the processing of ethnicity includes at least two different stages. The first stage consists of mechanisms such as detection, categorization and automatic evaluation of ethnicity. Brain regions that have been

associated with this stage are the amygdala and FFA. The other stage requires higher personal and societal motivations and functions as a control mechanism for the lower-order processes. This stage has been linked to ACC and DLPFC. This model implies that the processing of higher order personal and societal motivations have an influence on lower order aspects of a person's interpretations of the perceived person, including for example stereotypical evaluations derived from ethnicity (Kubota et al., 2012).

## 4. Methods for measuring physiological and neural processes

In this section there will be a presentation of methods that have been used for measuring physiological and neural processes in the studies that will be presented. Different measurement methods measure different aspects of the empathy processes and all of them have their advantages and disadvantages, which is very important to bear in mind when going through the studies that will be presented in the next section. The measurements that will be presented include those that most commonly have been used. These are measures of skin conductance response (SCR), electroencephalography (EEG), functional magnetic resonance imaging (fMRI), transcranial magnetic stimulation (TMS) and the implicit attitude test (IAT).

### 4.1. SCR

By measuring SCRs data can be provided that demonstrates the amount and speed of autonomic reactivity to a stimulus. This measurement measures small changes in skin conductivity which takes place as a result of sweating, which is used as an indicator of psychological or physiological arousal. This can be done since it has been seen that arousal results in increased activity in the sweat glands, which in turn results in increased skin conductance. In this way, skin conductance can be used as a measure of emotional responses (Neumann & Westbury, 2011). It is also worth mentioning that there seems to be a positive correlation between SCRs and activity in ACC and it is suggested that ACC plays an important role in the production of the SCRs (Critchley, Elliot, Mathias & Dolan, 2000).

The advantage of this measurement is that it can measure bodily responses, which often are present in the absence of awareness of a stimulus and are furthermore relatively easy to record and analyze (Ward, 2012). The disadvantage of measuring SCRs is that the SCRs are sensitive to a various different processes, such as orienting, sustained attention, stimulus significance, and the affective intensity of a stimulus (Neumann & Westbury, 2011). This means that one cannot simply link the SCRs to a specific brain process.

**4.2. EEG**

This measurement is used by placing electrodes along the surface of the scalp. In this way electrical activity that stem from the firing of neurons can be registered, providing an index of when neural activity occurs. Through EEG data is provided that reflects neural activity from all parts of the brain. Short-term changes in the EEG can be evoked by different stimulus event, and these short-term changes are referred to as event-related potentials (ERPs) (Neumann & Westbury, 2011).

The advantage of EEG is that it provides excellent temporal resolution and is a direct measure of neural activity. However, the disadvantage is that the spatial resolution is very poor. First of all there are sub cortical brain regions that are impossible to investigate through EEG. Secondly, the activity that is recorded at a certain region of the scalp doesn't have to reflect neural activity near to that region. This is because activity in one location can be detected in very distant locations. Hence, generally EEG isn't well suited for detecting the location of neural activity (Ward, 2012).

**4.3. fMRI**

This is a type of neuroimaging technique and, in contrast to EEG, it can provide precise information about the spatial localization of brain regions (Neumann & Westbury, 2011). FMRI measures changes in blood flow, since it is assumed that these changes correlate in time and space with neural activity (Neuaman & Westbury, 2011).

The advantage with fMRI is the good spatial resolution, whereas the disadvantage is the poor temporal resolution and the fact that it is only an indirect measure of neural activity (Ward, 2012).

**4.4. TMS**

This method is used to stimulate the cerebral cortex by placing a coil on the scalp. Trough this coil a strong electrical current runs which will generate a magnetic, field that can either inhibit or stimulate the firings of neurons in the underlying region. TMS infers whether a given brain region is critical for a task and if so, to what extent. If it's important for the task, then interference will occur, because of the dial use of the region, when it comes to the demands of the task, together with the activity induced through the stimulation made by the coil. This results in that the more activation in the region of interest that is seen during a task (e.g. perception of a certain stimulus) the stronger inhibition of the neural activity will be seen (Neuman & Westbury, 2011).

The advantage of TMS is that it can be used to investigate both the timing and the location of a neural processes whereas the disadvantages is that it can only stimulate certain brain regions (Ward, 2012) and that the effects of TMS in general are quite brief (Gazzaniga et al., 2002).

**4.5. IAT**

The IAT is a commonly used measurement of implicit preferences about social attitudes, hence the test can give access to deep cognitive domains that can't be detected using self-report measures (Greenwald, McGhee, & Schwartz, 1998). In the studies of EEB a version measuring the implicit attitudes regarding ethnicity is commonly used for examining potential correlations between these attitudes and the EEB. The IAT is based on participants' reaction times on a computer-based categorization task. It assesses the association between two classes of stimuli (e.g. ethnicity vs. positive and negative words such as joy, friend,

terrible, awful) by measuring differences in the response speed that participants show in the same task with exemplars from two categories. Faster response speed during the association of a certain ethnicity with negative words indicates stronger implicit negative attitudes towards that ethnicity (Greenwald et al., 1998).

## 5. Concepts

A presentation of some concepts that are relevant, when going through the studies in the field of EEB, will now be presented. The reason for why these concepts are important in the studies of EEB is that they all have been seen to be able to affect empathic responses, hence when searching for potential underlying mechanisms for the EEB these concepts have commonly been mentioned. The concepts are ingroup vs. outgroup, ingroup bias, attitudes and evaluations, culture and self-other similarity.

### 5.1. Individuation vs. categorization

Regarding perception of faces two basic abilities exist, named categorization and individuation. Individuation refers to the tendency to perceive other people as unique persons and not just as members/ symbols of a social group. This stands in contrast to categorization that refers to people's tendency to characterize others, based on the social groups the targets belong to (e.g. ethnic membership, gender, outgroup). In this way, instead of being perceived as an individual, they are perceived as a symbol of a group, meaning that category based beliefs, such as stereotypical thoughts about the target, is what guide the perceiver's appraisals and their responses (Mason & Macrae, 2004).

### 5.2. Ingroup vs. outgroup

Ingroup refer to the group one belongs to and identifies oneself with whereas, outgroup refers to "the others". Gender, age, profession, ethnicity, status, country of birth, sports team, social group and education are just a few examples that we use to categorize people as belonging either to the ingroup or outgroup (Tarrant, Dazely & Cottom, 2009).

### 5.3. Ingroup bias

It has been seen that the way in which people categorize themselves and others, in term of their social group memberships, has a powerful influence on how they interpret and respond to social phenomena (Tarrant et al., 2009; Volz, Kessler & von Cramon, 2009). Individuals seek to achieve a positive self-image and it is a common phenomenon to favour fellow ingroup members in evaluations and behaviour as well as to neglect or even discriminate against people from various outgroups (Harris & Fiske, 2006; Tarrant et al., 2009).

### 5.4. Attitudes

Attitudes are thought of as central for an understanding of human behaviour (e.g., categorizing persons as ingroup or outgroup members). Attitudes are referred to as rather stable set of representations of a stimulus (e.g. whether something is good or bad) (Biel & Gärling, 2012).

It has been seen that our social attitudes bias how we perceive and process others (Biel & Gärling, 2012). For example, we have a harder time to recognize outgroup members' faces and to interpret their facial expressions (Wiese, Kaufmann, Schweinberger, 2014). Outgroups are furthermore less likely to activate neural areas for social cognition (Haris & Fiske, 2006) and social perception (Van Bavel, Packer, & Cunningham, 2008). It has been seen that attitudes can either be conscious (explicit) or unconscious (implicit) (Beil & Gärling, 2012, Greenwald et al. 1998). Neuroscientific studies has revealed that results in IAT for implicit attitudes regarding ethnicity can predict the neural activities in certain brain regions involved with the processes of ethnicity (Kubota et al., 2012).

### 5.5. Culture

Culture can have many definitions. In this context it is referred to as set of values, skills, customs and beliefs amongst a group of individuals or society and is a way of

distinguishing between different social groups (Ward, 2012). Cultures can vary in the extent to which people prefer social hierarchical (a system in which members of a society are ranked according to relative status or authority (Chiao, Mathur, Harada & Lipke, 2009)) over egalitarian (favours equality for everyone) relations between individuals and groups (Cheon et al., 2011). It has been seen that a stronger preference for social hierarchy is associated with a decrease in empathic responses during the perception of pain in others (Chiao et al., 2009).

### 5.6. Similarity

It has been suggested that similarity between one self and another person signifies that the self and the other are "of the same kind". It has been seen that when people recognize different aspects of themselves in others, the other's welfare becomes of immediate self-relevance, which in turn has been suggested to increase the likelihood of the experience of empathy and subsequent helping behavior (Sturmer & Snyder, 2006).

## 6. Scientific studies examining the EEB

In this section studies in the field of EEB will be presented. This section is divided into two subsections, where the first one consists of studies demonstrating an EEB and the last one includes studies demonstrating that EEB isn't inevitable. Each of the subsections will present the studies in chronological order.

### 6.1. Studies where an EEB has been seen

#### 6.1.1. Do You Feel My Pain? Racial Group Membership Modulates Emphatic Neural Responses.

The first fMRI study that provided evidence for the effect ethnicity has in brain areas associated with empathy was carried out by Xu et al. (2009). They wanted to investigate the neural mechanism underlying the EEB and furthermore they were interested in examining the hypotheses that the reduction of empathic neural responses for OEM is independent of the ethnic membership of the perceiver. The participants consisted of Chinese and Caucasians

(e.g. persons with white skin colour) including Americans, Dutch, Italian, German, Russian and Israeli. The participants were scanned while being presented with video clips of Caucasian and Chinese actors, demonstrating a neutral facial expression that was touched on the cheek either by a needle (painful stimulation) or a q-tip ( non-painful stimuli). Furthermore, the participants in this experiment filled in questionnaires regarding cultural values and ethnic identity. The results differed across the participants in that the Chinese demonstrated higher collectivistic values than the Caucasians and also showed stronger identification with one's ethnicity. The Caucasians on the other hand scored higher on the individualism scale compared to the Chinese. Despite these differences Chinese and Caucasians demonstrated similar EEB. The results showed that ethnicity had an effect on ACC, supplementary motor area (a brain region that has been associated with the linking of cognition with action (Nachev, Kennard & Husain, 2008)) and insula, where more activation in these areas was seen when watching SEM being painfully stimulated, compared to OEM. The EEB in these areas was demonstrated both in the Chinese and Caucasian participants. . Based on the findings, the authors concluded that the ethnicity of the perceiver didn't have any effect on the EEB. They proposed that, in comparison with the influence that culture can have on empathy, if ethnicity has an effect on empathic responses it is more fundamental and deeper than the potential influences that cultural values have (Xu et al., 2009).

#### 6.1.2. Racial Bias Reduces Empathic Sensorimotor Resonance with Other-Race Pain.

One year later a study was published by Avenanti et al. (2010). In this study the authors wanted to examine potential differences in sensorimotor resonance and physiological responses between the perception of SEM and OEM in pain. They also wanted to investigate underlying mechanism behind a potential seen difference in empathic responses with a focus on the effect implicit attitudes might have. White-Caucasians (Italian) and black-African

(born in Africa but living in Italy) participated and they were instructed to observe and pay attention to video clips showing stranger black or white hands, being either penetrated by a needle (painful stimuli) or being stimulated by a q-tip (non-painful stimuli). TMS was used to measure the potential occurrence of sensorimotor resonance, which was indexed by greater inhibition of corticospinal excitability specific to the muscle the participants observed being penetrated. Physiological responses were measured by SCRs and changes in heart rate (which provides information about automatic reactivity such as attention and orienting responses). The experimenters also had the participants take an IAT test, so they could look for potential correlations between implicit attitudes and the degree of sensorimotor resonance. First of all, it was found that a clear preference for SEM compared to for OEM in both white and black participants existed. It was furthermore found that both Black and White participants demonstrated an automatic reduction of the corticospinal excitability of the participants during the perception of the painful stimuli, hence indicating that a sensorimotor resonance occurred. However, this effect was only seen during the perception of the hands with the same skin-tone as the perceiver, indicating that ethnicity had an effect on the neural responses during pain-perception. Furthermore, it was seen that the degree of sensorimotor resonance correlated with the scores on the IAT where higher implicit ethnicity-bias resulted in a decrease in sensorimotor resonance, indicating that attitudes had an effect on the EEB.

It was furthermore found that despite the modulation that ethnicity had on the sensorimotor responses, a similar increase in SCRs was seen during the perception of both the white and the black hands, regardless of the ethnicity of the participants, indicating that a similar emotional arousal response was evoked, unaffected by ethnicity. However, ethnicity seemed to have an effect on the latency (time-sequence) of the SCRs ethnicity, since it was lower for the hands with the same-skin tone as the perceiver compared to the other hands. The authors proposed that the results from the SCRs measures demonstrated that even though

the degree of emotional reactivity wasn't affected by ethnicity, the time for which an emotional reaction occurred seem to be modulated by ethnic membership, where the perception of the hands of SEM resulted in a faster response. When it comes to the heart rate it was seen that a small, but still significant, reduction in an early time window occurred during the perception of both SEM and OEM being painfully stimulated. However, a difference was seen in that the heart rate was lower during the perception of SEM being stimulated, indicating that a faster and greater orienting and attentional response occurred. It was further found that this difference was correlated with people's implicit attitudes against OEM in that more negative attitudes resulted in greater orienting response to SEM than for OEM, which the authors suggested could be interpreted in that these persons found stimulations of SEM being more important and salient.

In a follow-up study, where the experiments wanted to look further into the underlying mechanism behind the EEB, a violet skin hand that wasn't representing a specific ethnic group was added. As mentioned previously, similarity has been seen to have an effect on empathic responses. By adding this violet skin hand the researchers could investigate whether perceived similarity affected the EEB. The authors hypothesized that if the EEB was caused by culturally acquired ethnic attitudes, an increase in empathic responses would be seen for the culturally unmarked violet hands, compared to the other-ethnicity hands. If, on the other hand, the EEB mainly was caused by familiarity/similarity, greater empathic responses would be present for other-ethnicity hands than for the violet hands. Measurements were conducted using TMS. Even though this violet-skin coloured hand was judged as being the most unfamiliar and dissimilar by both Caucasian and African, a clear sensorimotor resonance was still found when watching this hand, but not during the perception of the other hands that represented OEM (black vs. white). Based on these results, they suggested that the bias largely was influenced by culturally acquired attitudes.

### 6.1.3. Neural basis of Extraordinary Empathy and Altruistic Motivation.

An fMRI study by Mathur et al. (2010) provided support for an EEB and furthermore that the EEB differed depending on the ethnicity of the empathizer. The experimenters wanted to examine what neural correlates underlie the EEB and also if ethnicity had any effect on altruistic behaviors. In the study African-Americans and Caucasian-Americans were presented with scenes of Africans and Caucasians in emotional pain (e.g., people experiencing a natural disaster) or neutral situation (e.g., eating together). After the watching of the visual scenes of persons in pain the participants were asked how much money and how much time they were willing to donate to help each person that had been presented on the screen. The participants were furthermore asked to complete various tests regarding preference for social hierarchy or egalitarianism, degree of identification with one's own ethnic group and potential negative implicit attitudes towards OEM.

First of all, behavioral results showed that no difference between the two ethnic groups was seen in degree of preference for egalitarianism. Furthermore it was revealed that no correlation between implicit negative attitudes towards OEM was seen neither in neural empathic responses nor motivation to behave in an altruistic manner. Regarding degree of identification with SEM African-Americans demonstrated stronger identification with SEM compared to the Caucasian-Americans. When it comes to the neural responses, activity in MPFC was demonstrated in African-Americans when they observed SEM in pain compared to the Caucasian-Americans, who didn't demonstrate activity in this area when they saw SEM expressing pain. Instead, Caucasian-Americans demonstrated an increased activity parahippocampal gyrus and PCC during the perception of SEM compared to OEM being in emotional pain. These activity patterns in the Caucasian-Americans are consistent with previously found evidence of an increase in encoding-related neural activity during the perception of ingroup-members (Golby, Gabrieli, Chiao & Eberhardt, 2001). It was revealed

that African-Americans were willing to donate significantly more money and time to help SEM than OEM. Caucasian-Americans motivation to help wasn't significantly modulated by ethnicity. Finally, it was seen that the activity in MPFC observed in Afro-Americans during the perception of pain showed a positive correlation with the empathic responses and the motivation to help SEM. The authors suggested that their result might demonstrate that the EEB, and the subsequent bias in altruistic motivation behavior that was seen in the Afro-Americans, was caused by their inclusion of other group members into their self concept (as seen by the high degree of identification with SEM that the Afro-Americans demonstrated). The activity in the MPFC that was seen in the current study was suggested to reflect greater self evaluative processes when viewing SEM relative to OEM in pain, maybe due to greater perceived similarity between SEM relative to OEM (Mathur et al., 2010).

#### 6.1.4. Cultural Influences on Neural Basis of Intergroup Empathy.

Cheon et al. (2011) carried out an fMRI study examining the EEB and underlying factors behind this EEB. They hypothesized that cultural variation in hierarchy preference (social hierarchy vs. egalitarianism) would have an effect on the EEB where higher preference for social hierarchy would lead to greater EEB. The participants consisted of Korean and Caucasian-Americans and the stimuli were similar as in the study by Mathur et al. (2010) (scenes of people in emotional pain). Behavioral tests regarding the degree of preference for social hierarchy or egalitarianism were carried out. It was revealed that a difference was seen across the ethnic groups where higher degree of preference for social hierarchy was seen in the Koreans compared to for the Caucasian-Americans who demonstrated higher degree of preference for egalitarianism. Greater activation in MPFC, TPJ, PCC and precuneus, was seen when the participants were watching SEM compared to OEM in pain. Differences in neural responses were furthermore seen between the Korean and Caucasian-American participants, where the Koreans demonstrated a stronger EEB and also more activity in TPJ than the

Caucasian-Americans did. Activity in the TPJ was associated with the preference for social hierarchy, in that stronger preference lead to more neural activity within this region. This lead the authors to suggest that their results indicate that the bias in neural response for OEM, that was demonstrated was caused by variations in cultural values, more specifically regarding the degree of social hierarchy. It is important to add that even though the Korean participants demonstrated greater EEB and empathy still occurred to OEM, which can be interpreted in that the Korean participants may be engaging in "extraordinary empathy" or stronger empathy for SEM, rather than indifference of hostility towards the OEM. The authors concluded by proposing that their results indicate that the EEB was caused by variations in cultural values, more specifically by variations of preference for social hierarchy, due to increased engagement of brain regions associated with representing and inferring the mental states of others (Cheon et al., 2011).

#### 6.1.5. Racism and the Empathy for Pain on our Skin.

Another study that measured empathic reactions was carried out by Forgiarini et al. (2011). The aim of this study was to provide experimental evidence that an EEB exists when it comes to automatic, physiological reactions to other people's pain. In this study the participants consisted of Caucasian (Italian) and SCRs was used as an index of the physiological arousal. A series of video clips, showing either a Caucasian, Asian or African being painfully or non-painfully stimulated, was presented to the participants. Compared to the previous mentioned study by Avenanti et al. (2010), instead of just presenting hands and letting the only cue for the ethnic membership be the skin-tone, in this study the clips started with the demonstration of a face of a female or male with a neutral expression. After that, the camera zoomed in on the person's hand, which subsequently was stimulated either by an eraser (non-painful stimuli) or a needle (painful stimuli). By using videos demonstrating members of not only two but three different ethnicity members, the authors acquired results

that didn't just indicate potential differences between SEM and OEM, but also whether the type of ethnicity had an effect on the empathic responses. The results revealed that the ethnicity of the actor had an effect on the SCRs. Heightened SCRs was seen when all the ethnic members were inflicted with pain. However, the SCRs were smaller during the perception of Africans experiencing pain. No difference was however seen between Asian and Caucasian actors.

The authors conducted a second experiment with the aim to examine whether a correlation existed between implicit negative attitudes and the EEB. The same paradigm as in their first experiment was used, but in addition the participants (also Caucasians) completed an IAT regarding attitudes towards Caucasians and Africans. The results revealed that emotional reactivity during the perception of pain, in the actors presented on the videos, correlated with the participant's implicit ethnicity attitudes, where higher negative attitudes resulted in diminished SCRs. Based on this, the authors suggested that the underlying mechanism for the seen EEB in their study was differences in implicit attitudes. Based on the results from the first study they ruled out the possibility that a more general in-group-bias could explain the result by arguing that the neural responses for African and Asian wouldn't differ if an ingroup-bias would be behind the results, since both ethnic groups would be included in the outgroup.

#### 6.1.6. Intergroup Differences in the Sharing of Emotive States: Neural Evidence of an Empathy Gap.

In this study by Gutsell and Inzlicht (2012) the aim to measure activity in the left and right prefrontal cortex. Previous studies have shown that activity in the right prefrontal cortex has been associated with withdrawal-related motivational and affective states (e.g. fear, sadness) whereas activity in left prefrontal cortex has been associated with approach-related motivational and affective states (e.g. happiness, anger). The authors predicted that similar

activity in right prefrontal cortex would be seen in the participants while experiencing sadness as when they observe SEM expressing sadness but that this similarity in activity wouldn't occur during the observation of OEM expressing sadness. Furthermore they predicted that this lack of neural activity for OEM was correlated with participant's level of negative attitudes where more negative attitudes would lead to less similar patterns in right prefrontal cortex for OEM. The participants consisted of Caucasians-Americans, East Asians and South Asians which all had non-black ethnic backgrounds. By using EEG the authors compared the activity over the left and the right prefrontal cortex when participants experienced sadness and when they watched other persons experiencing sadness. The perceived persons were presented on a screen and had different ethnic backgrounds (Caucasian-Americans, African, South Asian and East Asian). The participants first-hand experience of sadness was induced by letting them in a vivid way, remember a past sad event in their life. Tests measuring participant's attitudes towards different ethnic memberships were also carried out. The authors found similar activation patterns in the participants when they felt sad as when they observed SEM expressing sadness. However, this similarity in activation patterns wasn't seen during the observation of OEM, an effect that was strengthened by negative attitudes towards OEM. The authors concluded that their results indicate that a similarity in emotional/motivational states during first-hand experience of sadness and the observation of SEM expressing sadness occurs but this strong effect isn't present when seeing OEM being sad. The authors propose that an EEB occurs and that this is affected by the perceiver's attitudes towards OEM where more negative attitudes result in greater EEB.

#### 6.1.7. Their Pain is Not Our Pain: Brain and Autonomic Correlates of Empathic Resonance With the Pain of Same and Different Race Individuals.

In the study by Avenanti et al. (2010) ethnicity was seen to have an effect on corticospinal reactivity measured by TMS and autonomic reactivity in the form of SCRs. To

examine whether there also exists a difference in the brain areas typically involved in the processes of pain Azevado et al. (2012) conducted a similar study where Caucasian-Italian and Black-African participated. The participants were presented with clips showing black-, white- and violet-skinned hands being either painfully or non-painfully stimulated. Instead of TMS and SCR, fMRI was used. Azevado et al (2012) was also interested in potential differences in automatic reactivity. One way of measuring this is through the registration of pupil dilation, which was done in this experiment. Furthermore they were interested in investigating potential underlying mechanisms behind the EEB and the focus was on the potential effect that implicit attitudes and judgments of similarity and familiarity with the target in pain. Therefore an IAT were carried out and tests where the participants were to make judgments of similarity and familiarity with the hands seen in the videos. Caucasian-Italian and Black-African participated. The results revealed an EEB in AI, where greater activity was seen during the perception of painful stimuli inflicted in the hands of SEM, compared to in the hands of OEM and the violet hands. Furthermore, it was seen that activity in anterior medial cingulate cortex (aMCC) was larger for the hands of SEM compared to that of the hands of OEM and the violet hands, although the difference in activity wasn't as large as for the difference in activity in AI. When it comes to automatic reactivity it was seen that the participants reacted faster to the perception of SEM being painfully stimulated compared to for OEM and violet hands, with faster reaction time for OEM than for the violet hands. Larger pupillary responses was seen to the pain of SEM compared to OEM and this bias paralleled the activity in the AI, which the authors interpreted as a confirmation of greater emotional engagement with the pain of SEM. Regarding underlying mechanisms behind the EEB it was seen that both Caucasian-Italian and Black-African judged the hand with the same skin colour as their own as being more familiar than the other two and the violet hands were judged as being the most unfamiliar. When it comes to similarity, both Caucasian-Italian and

Afro-Americans rated the SEMs hands as being the most similar and the other two groups of models were judged as equally dissimilar. When it comes to implicit attitudes both Caucasian-Italian and Black-African demonstrated an implicit preference toward SEM. A correlation between degree of EEB and perceived familiarity and similarity was seen where higher degree of familiarity and similarity lead to greater empathic responses. However, the authors point out that because of the intrinsic relation between ethnicity and perceived familiarity and/or similarity the effect that ethnicity might have on the empathic responses can not be differentiated from the potential effect that the perceived familiarity and/or similarity has. Regarding a potential correlation between EEB and implicit attitudes it was found that the EEB in AI could be predicted by the implicit ethnic bias. Greater implicit negative attitudes toward OEM resulted in greater activity during the perception of induced pain in the hands of the SEM, compared to for the hands of OEM. The authors proposed that the results in their study demonstrated that both implicit attitudes and perceived familiarity and similarity have an effect on the EEB, resulting in greater emotional engagement with the pain of SEM. They emphasize the effect the implicit attitudes have and propose that these play a key role when it comes to modulations of the EEB.

#### 6.1.8. Racial Bias in Neural Empathic Responses to Pain.

In this study conducted by Contreas-Huerta et al. (2013) the authors were interested in finding the answer regarding why an EEB can occur. They were especially interested in if it was caused by a more general ingroup-bias, (e.g. that it isn't ethnicity per see but rather the distinction of SEM belonging to one's ingroup and OEM belonging to the outgroup). The participants consisted of Chinese and Caucasian-Australian. The authors assigned the participants into two mixed-ethnicity teams, with the aim of manipulating who the members of one's ingroup were (e.g. instead of persons sharing the same ethnic membership, the ingroup members were now the one's belonging to the team they had been assigned to). The

participants were told that they were assigned to a group with persons sharing the most similar beliefs and attitudes to them, and that the other group consisted of people with the most dissimilar beliefs and attitudes compared to their own. In reality the group assignment was completely random. Using fMRI, neural empathic responses were measured when participants observed the faces with neutral facial expressions, of the members of their own team or other team, and members of their own ethnicity or other ethnicity, receiving either painful or non-painful touch. When participants witnessed others receiving painful touch, an increase in activation in the core neural network for pain empathy, including somatosensory- and affective-motivational aspects of pain processing, was found. However, even though greater association with in-group members, compared to out-group members, (referring to the different teams) was found in both implicit and explicit measures, no ingroup-bias in neural responses was found during the observation of the painful stimuli. Instead, an EEB, with increased activation for SEM in insula was seen, unaffected by the team-membership. Other regions associated with empathy such as the ACC and left somatosensory areas, also showed indications of an EEB, although this bias wasn't significant. Even though this manipulation of group-memberships didn't have any effect on the EEB, the authors didn't exclude the possibility that the EEB indeed can be explained by a more general ingroup-bias. They base this proposal on the suggestion that the neural differentiation of ethnicity occurs at a more basic level than more general social distinctions, such as differences in beliefs and values, hence using only this as a way of distinguish ingroup- from outgroup members isn't enough to override the more basic and autonomic distinction of ingroup- from outgroup members based on ethnicity.

### 6.2. Studies where no EEB has been seen

#### 6.2.1. Manipulations of Cognitive Strategies and Intergroup Relationships Reduce the Racial Bias in Empathic Neural Responses.

Now a study that both demonstrate the occurrence of an EEB but also an absence of it will be presented. The study was conducted by Sheng and Han (2012). The authors hypothesized that an underlying factor behind the EEB is that people to a greater extent focus on individual features during the perception of SEM compared to during the perception of OEM, where more categorization processes are at work, resulting in that OEM is perceived as a symbol of the ethnic group membership and not as an individual. This would lead to a diminished processing of facial expressions during the perception of OEM than for SEM. The participants consisted of Chinese and EEG was used. The participants were shown faces of SEM and OEM with either neutral or painful expressions, where Caucasians represented OEM and Chinese represented SEM. These faces were presented on a screen. The participants were instructed to perform ethnicity judgments and pain judgments on faces of SEM and OEM (Chinese and Caucasian). The authors' hypothesis was that a reduction in EEB would be seen when participants judged the faces according to the facial expressions and not according to their ethnic membership. They further hypothesized that by manipulating the attention of the participants so that enhanced attention would be on the facial expressions (pain-judgment-task) and reduced attention on ethnic features, an increase in empathy-related neural activity for OEM would occur. The recorded ERPs revealed that an EEB was seen in the ethnicity-judgment task where pain expressions in SEM increased neural responses at 128-188 ms after the stimulus onset, an effect that wasn't seen for OEM. However, as the authors had hypothesized, no EEB was seen when the participants performed the pain judgment task. In a follow-up experiment, where the participants still consisted of Chinese, the experimenters wanted to investigate whether the intergroup relation between the empathizer and the person in suffering could have an effect on the EEB. Therefore, just as in the experiment that was conducted by Contreas-Huerta et al. (2013), the participants were assigned to a mixed-ethnicity team (Caucasians and Chinese). Note that this study was

published a year before the study of Conreas-Huerta (2013). The participants were divided into a “green” team and a “blue” team. Colours of the t-shirts (blue vs. green) defined the team-membership. Note that by the use of colours of the T-shirts as a way to differentiate team-membership, the participants can distinguish ingroup- from outgroup members by using a cue that is more salient and is processed earlier than more complex social categorization such as beliefs and attitudes that were used in the experiment carried out by Contreas-Huerta et al., 2013. The participants were told that they had randomly been assigned to these teams for a competitive game. An ethnicity judgment task on own- and opposite team members was to be carried out on faces with neutral or painful expressions. Before this ethnicity- judgment tasks, the participants performed different learning tasks with the aim to learn who belonged to their own team and who belonged to the rival team. By analyzing the ERPs it was revealed that the EEB, which had been seen during the ethnicity-judgment task in the previous experiment, had been reduced for the OEM that belonged to the same team. However, no difference in empathic responses were seen for the SEM in the opposite team, which the authors suggested could be because long-term life experiences with SEM might result in that one automatically focuses more on individual features on these persons compared to for OEM and that this automatic process is so strong that it can’t easily be manipulated by these sorts of manipulations of intergroup relationships. The authors interpret their results of these two studies by suggesting that the EEB isn’t inevitable and that it can be reduced through manipulations of intergroup relationships and perceptual processes. (Sheng & Han, 2012).

#### 6.2.2. Cultural experiences reduce racial bias in neural Responses to Other’s Suffering.

Inspired by Sheng and Han’s (2012) findings that the EEB isn’t inevitable and that an explanation can be differences in perceptual processes lead Zuo and Han (2013) to conduct an experiment testing this hypothesis. They suggested that if this proposal were correct real-life

experience, such as for example living in a society where OEM consist of the majority of the population, would lead to a reduction of the EEB because daily experiences with people lead to enhanced individuated processing of these. The participants consisted of Chinese adults who had been brought up in western countries where the majority of the population were Caucasian (United States, United Kingdom and Canada). Tests were carried out examining whether the participants identified themselves as Asian ethnicity members and the results demonstrated that this was the case. Just as in the experiment by Avenanti et al. (2009) the participants were shown video clips, of either Asian or Caucasian neutral faces being stimulated either by a needle (painful stimulation) or by a q-tip (non-painful stimulation). fMRI was used. The results revealed that increased activity in empathy-related regions including ACC, AI, IFG and somatosensory cortex was seen during the perception of the painful stimulation, but no significant difference in activity was seen when perceiving SEM compared to OEM. Based on this, the authors concluded that cultural experience with OEM can enhance neural empathic responses, leading to a reduction of the EEB. Their results provided further support for Sheng & Han's (2012) proposal that an explanation behind the EEB can be the difference in how one processes SEM and OEM (SEM are perceived more as individual whereas OEM are perceived more as symbols of a group (Zuo & Han, 2013).

#### 6.2.3. Task Modulations of Racial Bias in Neural Responses to Other's Suffering.

Two years after the experiment conducted by Sheng and Han (2012) it was replicated by Sheng, Liu, Li, Fang & Han (2014). The authors wanted to look further into witch brain regions that were involved in the reduction of the EEB that was seen during the pain-judgment task compared to in the ethnicity-judgment task. Due to the low spatial resolution of ERP signals, in Shen and Han's (2012) study it wasn't possible to gain information regarding in exactly which brain regions neural responses to the suffering of OEM were increased by

differences in task demands. Therefore fMRI was used in this experiment. Just as in the study by Sheng and Han (2012) an EEB was seen during the ethnicity judgment task where no special attention was directed on the individual expressions. This bias was especially seen in that an increase in activity in ACC and AI during the perception of SEM was seen, compared to for OEM. Furthermore, as in Sheng & Han's (2012) study, the EEB was reduced during the pain judgment task, where an increase in activity in ACC and AI now also was seen during the observation of OEM in painful expressions. Similar as Sheng & Han (2012) and Zuo and Han (2013) the experimenters suggested that these results supported the hypothesis that an underlying factor behind the EEB can be people's tendency to perceive OEM not as individuals but instead as a symbol of a social group and that this bias isn't inevitable (Sheng et al. 2014).

## 7. Discussion

Empathy is the ability to understand and share the emotional states of others and is crucial for good functional social relationships (Decety & Jackson, 2004). No definite agreement on how to define empathy exists (de Vignemont & Singer, 2006). Concepts such as contagion, mimicry (Singer & Lamm, 2009), perspective-taking, ToM (Engen & Singer, 2013) and perception-action coupling (Preston & de Waal, 2002) are being used when trying to explain the concept of empathy. The hypothesis of shared networks, meaning that similar neural responses that occurs when one has an emotional experience also occurs when watching another person has that experience, is commonly used as guidance in this research field (Engen & Singer, 2013; Preston & de Waal, 2002). It is furthermore suggested that empathy consists of both affective and cognitive components (Bernhardt & Singer, 2012). Brain regions that have been associated with empathy includes somatosensory cortex, ACC, AI, IFG, MPFC, TPJ, where the ACC and AI has been seen to be the key regions in empathic responses (Baron-Cohen, 2012). There are many factors that can influence an empathic

response (de Vignemont & Singer, 2006) and it has been seen that ethnicity is one of them (Avenanti et al. 2010; Azevado et al. 2012). The processing of ethnicity is complex and it has been revealed that ethnicity affects brain regions, such as the amygdala, FFA, DLPFC and ACC (Kubota et al. 2012). In the research field that investigates the EEB different measurement has been used such as measures of SCR, heart rate, pupil dilation, EEG, fMRI and TMS. The majority of the studies examining the EEB have demonstrated that ethnicity can have an effect on empathic responses and that both the ethnicity of the empathizer and the ethnicity of the target can affect the empathic response. It has been revealed that faster and increased physiological arousal, greater sensorimotor resonance and greater activity in empathy-related brain regions such as ACC, AI, MPFC and TPJ, can occur during the perception of SEM in pain compared to OEM.

However, there are inconsistencies in the results in this research field in that there have been studies where no EEB has been seen (Sheng & Han, 2012; Sheng et al., 2014; Zuo & Han, 2013). It has for example been seen that whereas ethnicity have had an effect on ACC in some studies it hasn't been seen in all studies.

When it comes to the underlying mechanisms behind the EEB that has been seen in the majority of the studies no definite agreement exists in what these are. Even though the majority of the studies demonstrate an EEB, the inconsistencies in the results that exist prevent one from concluding that ethnicity per se has an effect on the neural empathic responses. The results of the studies indicate that one can't rule out the possibility that there are other more general underlying mechanisms. Different theories regarding this have been tested. These theories includes that the bias is caused by a more general ingroup bias, differences in perceived similarity and familiarity, attitudes, culture and differences in the perception of SEM and OEM (the target is being perceived as a symbol of a group instead of an individual).

Indeed, one can suggest that studies where no bias occurs provides evidence that the EEB isn't caused by ethnicity per se. If ethnicity would be the reason behind the bias then one could suggest that no inconsistencies would occur. However, I suggest that one has to be careful drawing these conclusions, based on following arguments;

It can be argued that the conditions in the experiments have been made in such a way that the effect ethnicity has on the empathic responses simply have been overridden by other processes. Indeed, empathy is complex and there are a variety of factors that can influence the empathic response, as mentioned earlier in the thesis. This would mean that, just as Sheng & Han's (2012) result could indicate that EEB is caused by attention processes and ingroup-bias, it could just as well be interpreted as demonstrating that ethnicity has an effect on empathic response, but this effect isn't unavoidable and it isn't stronger than that it can be reduced by other mechanisms, such as attention processes and including OEM in one's ingroup, just as the authors suggest (Sheng & Han, (2012).

Another viewpoint that underlie my suggestion of cautiousness before drawing conclusions is that indeed, mechanisms such as attention processes, attitudes, culture, ingroup bias, similarity etc. influences the EEB, but it is ethnicity that, in an autonomic way, causes the existence of differences in attention processes, attitudes, ingroup bias, similarity etc.

This point of view could provide an explanation for the inconsistencies in the results. It could be interpreted as providing support that we are automatically biased to respond differently to OEM compared to SEM when it comes to empathic neural responses, and this is because ethnicity automatically and in a mandatory way evokes changes in attitudes, distinguishes outgroup memberships etc.

The proposal that there are special cognitive functions in the brain that are developed especially for the processesing of ethnicity has been rejected by Cosmides, 2003; Kurzban, Tooby & Cosmides, 2001). Instead it has been suggested that people's tendency to encode

OEM in autonomic and mandatory ways isn't due to ethnicity per se but instead is a by-product of adaption that through evolution has been evolved for the purpose of detecting alliances and coalitions, something that regularly was a part of the lives of our ancestors (Cosmides, 2003). Since physical similarity is a strong indicator of group membership (where physical similarity indicates that persons belong to one's ingroup), is something that often differ between people with different ethnicity and furthermore is something that is easily detected, in lack of other cues revealing group membership regarding alliances, persons make their judgment based on this. Indeed, it has been found that when person's are aware that physical features (e.g. ethnicity) aren't relevant for detecting coalitional affiliations but instead there are other cues present, relevant for revealing alliances, people significantly reduce the extent of categorizing according to ethnicity and can even do so entirely (Kurzban et al., 2001). Taking this viewpoint, the experiment by Sheng & Han (2012), where the EEB was reduced by dividing the participants into rival teams where the colours of the t-shirts were used as indicators of group membership, wouldn't be explained by the difference of physical features, which Contreas-Huerta et al., (2013) suggested in their discussion. Instead it could be explained in that the members of the different groups were rivals; they were to compete with each other, making the distinguishing between the different alliances more salient than just a mere division into different groups would have done.

The studies carried out by Avenanti et al. (2010) and Azevado et al. (2012) where violet hands were included according to the authors provided support for the hypothesis that it is similarity/familiarity and above all implicit negative attitudes that causes the EEB. Indeed, a correlation between these was found. However, I suggest that this might not be the only explanation for the EEB. Activity in the ACC was absent in the study by Avenanti et al. (2010), during the perception of violet hands in the painful stimulation, and there were indications of reduced activity in mACC (although not significant) in the study by Azevado

(2012). ACC is involved in the motivational aspects of empathic responses. Could a plausible explanation for the absence of activity in this region be that these violet hands were seen as something that didn't reflect "something real", and therefore resulted in a reduction of the motivation to respond in an empathic way? Indeed, it has been revealed that the reality of the context affect the activity in ACC. In the study by Gu and Han (2007) a reduction in activity was for example seen when the participants were shown cartoon pictures of hands in painful situations, compared to when the same situations was seen on "real-life" photos.

Other findings that lend support to the hypothesis that there isn't any special, inborn, cognitive mechanisms for the processing of ethnicity has been made in studies carried out on infants. In these it has been seen that the preference for the faces of SEM is seen first after the age of three month (Kelly, Quinn, Slater, Lee, Gibson & Smith, 2005). Furthermore, amygdala has been seen to react in a fast and autonomic way to the perception of OEM (Kubota et al. 2012). However, there is a study carried out on Caucasian-Americans where it was seen that this biased reaction for OEM, (in this study being Afro-Americans), was seen first in adolescence (Telzer, Humphreys, Shapiro & Tottenham, 2013). The studies carried out by Sheng &Han (2012), Sheng et al. (2014) and Zuo & Han (2013) further lends support for the suggestion that there isn't something special with ethnicity per se.

Another interesting finding was that no EEB was seen in neither ACC nor AI in the study by Mathur (2010) , and in the study by Cheon et al. (2011), no EEB was seen in a variety of empathy-related regions (MPFC, TPJ, PCC and precuneus). This stands in contrast with some of the other studies where a clear bias has been present. When looking for differences between these studies as a way of understanding the different results one can see that the set-ups have differed. In the two studies by Mathur et al. (2010) and Cheon et al. (2011) the participants have watched people being in a more complex context (experiencing a natural disaster) compared to the other studies where the participants merely have observed

faces or body parts. The context of a situation has been seen to affect empathic responses (Han et al., 2009). Furthermore, I suggest that one can propose that another difference between these stimuli is that direct painful stimuli, applied on a person's face or body part, indicates, to a greater extent, that the threat is limited to that particular person, compared to an environmental threat such as a natural disaster which might to a greater extent also be a potential threat to one self; a threat that might override the potential threat that a person belonging to another group pose, making the group-membership of the perceived person less salient.

Another interesting finding is that despite of the fact that the pictures demonstrated to the participants in the studies by Mathur et al. (2010) and Cheon et al. (2011) were similar, still the results between these studies differed..Something that however did differ between the studies was the ethnicities of the persons that participated. Whereas the participants were Chinese in the study by Cheon et al. (2011) the participants in the other study consisted of Afro-Americans and Caucasian-American, which can provide support that cultural differences can have something to do with the results.

Concerning the experimental set-ups it's important to stress that they indeed have differed in many ways. There are studies where photos have been used and there are studies where video clips have been used. Furthermore, in some studies the participants only have watched body parts being painfully stimulated and in others the participants have been presented with faces that have been induced with pain. Furthermore, when it comes to the studies demonstrating pain inflicted to faces there has been both those where the pain has been inflicted to neural faces and those where the pain has been inflicted on faces showing a painful expression. The contexts of the painful situation the participants have seen have also varied. Whereas in some studies the persons in suffering have been stimulated by a needle, other studies have demonstrated persons experiencing a natural disaster.

Regarding to what degree one can generalize the result it first needs to be said that there is a variety of different ethnicities in the world and the studies in this field have only looked at the empathic responses in persons belonging to some of these ethnic groups (Caucasians-Italians, Caucasian-Americans, Afro-Americans, Chinese and Koreans). Whereas some studies have shown that the ethnic membership of the participants didn't have any effect on the results, there are studies that have shown that a difference exists. These sorts of findings strongly indicate that the results cannot simply be generalized. It can provide us with information regarding the effect the ethnicity has that the participants in the experiments have belonged to, but it can't really be generalized to other ethnic groups. Another reason for the problem of generalizing the results is the lack of context that the perceived subjects have been presented in, in many of these experiments. Even though information regarding EEB during the perception of a hand being painfully stimulated is interesting all it really does is to provide us with information about the effect ethnicity has on empathic responses in that particular situation. Since in real life, events often aren't isolated but instead take place in some sort of context one should be very cautious in using the results from these types of studies to explain potential EEB that occurs in real-life.

These results are of great importance because they add valuable knowledge to those working with interventions with the aim to reduce the EEB. It's first when one knows what needs to be addressed for a change to occur, that a change can happen. Since a lack of empathic feelings for a person in pain can result in reduced motivation to help the person these types of interventions are of great value. Especially in today's society where people with different ethnic memberships become more and more mixed. The results are furthermore important because they add support for the suggestion that these sorts of EEB-reduction-interventions are needed, since indeed, in many cases people's empathic neural responses differ, depending on the ethnicity of the subject in suffering. These results further provides

support that interventions successively can be done since there are studies showing that the EEB isn't inevitable and can be reduced.

The results in this research field have shown that many mechanisms seem to be at work when it comes to the EEB. These results can be used in the way that when making EEB reduction interventions one can start with letting the persons that will participate in the interventions perform different forms of tests, both explicit and implicit, regarding attitudes, cultural values, degree of ethnic identification etc. In this way one would be provided with information revealing what the particular causes for the EEB are in these participants and based on that get a better idea on how the interventions will be carried out for this particular group.

I further suggest that these results can be used for everyone that comes across people with another ethnicity. First of all, just because the mere awareness that there exists such a phenomenon as EEB can make one reflect upon one's own behaviors. By being more conscious about one's own reactions and reflect upon them a huge difference can take place, especially for the target person in pain since it can be the thing that determines whether or not help will be provided. Secondly, this can make a person being more careful before judging other person's reactions. If a person doesn't respond in an empathic way or provides help to a person in need, it might not necessarily mean that the person is cold-hearted or explicitly favours SEM. Instead, it can be that the person, in an automatic, non-voluntary way, doesn't empathize in such a strong way, and hence simply aren't aware of to what extent the perceived person is suffering.

The knowledge about the fact that when authors have looked into the EEB there have been many differences in the set-ups and what has been measured (physiological responses, affective- and cognitive components) is very valuable, since it diminishes the risks of misunderstandings, when referring to the research regarding EEB. People are provided with a

deeper understanding of the variety of different aspects that need to be accounted for before interpretations of the studies' result can take place.

Regarding future directions, first of all, experimenters must be clear on exactly what aspects of empathy they are measuring. Furthermore, research including a greater variety of ethnic memberships is needed. More studies that combine different measurements are also important. Furthermore, it's of great value if more studies present the targets in suffering in more complex and more real-life contexts.

## Conclusion

The majority of the studies examining the EEB have demonstrated that the physiological and neural empathic responses differ between the perceptions of SEM compared to OEM where greater empathic responses are seen for SEM. It has been revealed that faster and increased physiological arousal, greater sensorimotor resonance and greater activity in empathy-related brain regions such as ACC, AI, MPFC and TPJ can occur during the perception of SEM in pain compared to OEM.

Based on the existing findings I suggest that the EEB-phenomenon that has been found isn't caused by ethnicity per se. Instead the explanation can be found in several other different mechanisms that have been seen to have an effect on empathic responses. These includes a more general ingroup bias, differences in perceived similarity and familiarity, attitudes, cultural values and differences in the perception of SEM and OEM. I suggest that these mechanisms can interact in various ways, working in conjunction with each other by strengthening or weakening each other's influence on the empathic response, all depending on, not ethnicity per se, but the context of the situation.

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