Connection error?

STUDYING THE RELATION BETWEEN SMARTPHONE USE AND EMPATHY

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Abstract

Smartphones are playing an increasingly important part in our lives as they count for one of the main ways of communication. However, as the smartphone's popularity rises, so does scepticism about its impact on people's social life and skills, including empathy. In this study, the influence of smartphone use on empathy experiences was examined, using a literature review. This literature review was done with a social cognitive -and neuroscientific approach. First, the neurobiological -and cognitive mechanisms underlying empathy were identified. Then, it was examined how this process is altered by the interference of smartphones and to what is known about the actual effect smartphones have on empathy. Finally, based on this knowledge, possible interventions to enhance empathy are analysed and suggested. It was concluded that empathic responses can be inhibited during online communication, due to the lack of visual and auditive feedback, making it harder to create a simulation and anticipate the other person's feelings. This is confirmed by research done on internet -and smartphone disorders, however research has yet to be done to the effect of regular use of smartphones. Smartphone use is expected to impact empathy during face to face interaction only when a person shifts its attention from the other to the smartphone (due to e.g. notifications). Finally, it was concluded that smartphones could also be used in interventions to increase empathy in humans.

Introduction

Over the past decades, technology changed the way humans interact with each other. Next to an offline social life, many people have an elaborate social life online. A big part of everyday conversations got replaced by social media, texts and email. The smartphone has therefore become a valuable everyday tool for many users (Sulleyman, 2017). It's therefore no surprise that over 2.5 billion people worldwide own a smartphone (Taylor & Silver, 2019) and they use it 3.3 hours (United States) on average a day (Meeker, 2018). Most of this time is spent on interaction and communication with other users.

The use of technology has many advantages: communication has become faster, easier and more accessible compared to times before the inventions of the computer, smartphone and internet. This enables people to have an efficient and fast paced lifestyle. Furthermore, it has become easier to get or stay in touch with people from different cultures and nationalities.

The introduction of these new forms of communicating and socializing do, however, raise concerns as well. Some people question the use of smartphones and social media as opposed to having real-life conversations (Jacobs, 2014). They are worried about the negative impact these innovations have on the quality and development of people's social life and skills. At the same time, people get distracted from their offline lives by their smartphone. This all creates concerns, especially in older generations, about the quality and development of people's social lives and skills. A societal discussion is observed: on one side there are people who think smartphones are an opportunity for people to connect, enhancing social experiences and skills. On the other side there are people who think smartphones are a threat to the development of social skills and the quality of people's social lives (e.g. Bindley, 2011; Stewart, 2013; Walters, 2015).

So far, science fails to formulate clear answers to the questions that are raised in this debate. However, it is important to understand the impact of smartphones on our everyday life and development, as awareness of this impact allows for anticipation to dangers and opportunities. Knowledge about the influence of smartphones on our social skills could also contribute to finding solutions to societal problems like cyber-bullying, phone addiction and discrimination.

One of the social skills that people are concerned about is empathy. There is a lot of debate amongst scholars about the definition of empathy. In this study, a common definition is used that distinguishes two different kinds of empathy: affective empathy and cognitive empathy. This definition was chosen as it allows to further specify the kinds of impact smartphones could have on empathy and this working theory is most commonly used in literature. Affective empathy is 'the ability to respond with an appropriate emotion to another's mental state' (Ward, 2017). Cognitive empathy is defined as 'the capacity to understand another's perspective or mental state' (Ward, 2017). The two kinds differ in the way that cognitive empathy focuses on the understanding of the individual, whereas affective empathy focuses on the interaction between people. Empathy is considered an important social skills, because it is a requirement to ensure good-quality relationship with people (especially in the in-group), which can give people more security and resources (Waal, 2008). Furthermore, being empathic is an essential skill for taking care of children and thus reproduction (Konrath & Grynberg, 2013). When it comes to the impact of smartphone use, concerns are mainly about affective empathy (e.g. Dahl, 2014).

In society there is thus a growing demand for answers regarding the influence of smartphone use on empathy. Although very little, there is some research that observe a decrease of empathy caused by smartphone use (Burch, 2013; Körmendi, 2015). However, these studies do not explain what causes this phenomenon. This study aims to identify the ways in which the use of smartphones influences empathy. The research question that will be answered in this study thus is: how is empathy influenced by smartphone use?

This study adds to the existing body of knowledge in multiple ways. First, it gives an insight in the way empathy works in the human brain and how this process is influenced by different environmental factors. In artificial intelligence, this knowledge can be used in the relatively new field of artificial empathy: the capacity for AI to correctly understand and respond to human emotion. When transforming loose knowledge from empathy research into a comprehensive, more systematic model will make it easier to comprehend and thus programme empathy into AI. Second, it adds to knowledge about human-machine interactions, which can be taken into account when designing smartphones as well as their applications. Third, it provides knowledge about the possibility of intervention methods to enhance empathy in people, including suggestions for applications of AI for this particular purpose.

Methods

In order to answer the research question, a literature review was conducted. For this review, literature from the fields of social cognition, social neuroscience and artificial intelligence was used. These (sub)disciplines were chosen as this study focuses on the influence of artificial intelligence on the cognitive experience of empathy in individuals. This requires knowledge about the neural and cognitive processes involved in empathy as well as knowledge about human-machine relations. The literature was retrieved through online scientific journals, databases and books on the subject. Searchwords included, but were not limited to (combinations of): 'cognitive empathy', 'affective empathy', 'social media', 'smartphone', 'interventions', 'cognitive development' and 'communication'.

In the first chapter, the neuroscience of empathy is discussed. It is explained what neural mechanisms are involved in creating the empathy experience and how the empathy network functions. Furthermore, the different varieties of the empathic brain are discussed and how they influence the processing of empathy. The second chapter discusses ways we use our mobile phones and the internet to interact with each other. These actions are linked to the cognitive process of experiencing empathy, described in chapter 1, and it is explained how the use of smartphones in these situations influence the cognitive experience of empathy. In the third and last chapter, possibilities for interventions to enhance empathy using artificial intelligence are discovered. Thereafter, conclusions will be drawn, followed by a discussion.

Chapter 1: A description of the empathic brain and cognition

As mentioned in the introduction, this study aims to identify the ways in which smartphone use could influence empathy experiences. The first step to answering this question, is to take a closer look to how people experience empathy in general. By outlining the general process from stimulus to response, it is possible to understand how empathy works on a neurological -and cognitive level. The process described will function as a baseline for how empathy is experienced. This baseline will be created in this chapter. Using this baseline, it is possible to see how the use of smartphones alternates this process. The use of smartphones will be integrated in this process in chapter 2.

To understand what the research question means, it is thus required to understand nature of empathy itself. In this chapter, this nature will be explained on two levels: the neuroscientific level and the (social) cognitive level. The neuroscientific level explains empathy specifically as a function of brain processes. The cognitive level explains empathy on a higher level, taking into account behavioural and social factors. In this chapter the question on hand is: what are neurological and cognitive mechanisms underlying the experience of empathy in the brain.

This chapter will discuss the underlying neural and cognitive mechanisms of empathy as follows: first an overview will be given of relevant neuroscientific theories about empathy. Then, cognitive factors influencing the experience of empathy will be discussed. This will be followed by a section in which the neuroscientific and cognitive theories will be integrated. Finally, neurological varieties of this model will be discussed. The chapter will conclude with a short conclusion for this chapter.

Neuroscientific theories on understanding others

When it comes to neuroscientific theories about how people understand each other, there are generally two main approaches: simulation approach (also known as simulation theory) and theorising approach (also known as theory-theory) (Gallese & Goldman, 1998). All theories on the underlying mechanisms of empathy can be categorised under one of these two theories. There is a lot of debate among scholars on this topic (Goldman, 1992; Ravensoft, 1998). However, it has to mentioned that the one approach does not per se exclude the other approach (Gallese & Goldman, 1998). There are also scientists who assume a hybrid of the two approaches is most accurate.

The simulation approach

The simulation approach claims that, in order to understand each other, the brain mirrors someone else's mental state, creating a simulation of the other person's emotional experience (Gallese & Goldman, 1998; Shanton & Goldman, 2010). Recreating the other person's mental state helps understanding and empathising with the other person. The simulation is created by a perceptual-motor system, meaning that mirror neurons in the pre-motor cortex fire when getting certain perceptual stimuli (Iacoboni, 2009; Kohler, et al., 2002). These perceptual stimuli come from neural substrates affiliated with emotion (recognition) (Goldman & Sripada, 2005). The recognition of emotions can happen in three ways: through direct verbal communication (Narumoto, et al., 2000; Kan, Kawamura, Hasegawa, Mochizuki, & Nakamura, 2002), through facial expressions (Goldman & Sripada, 2005) or through emotional prosody in speech (Buchanan, et al., 2000). The simulation approach is considered to be more domain-general. A visualisation of the simulation approach is shown in figure 1.
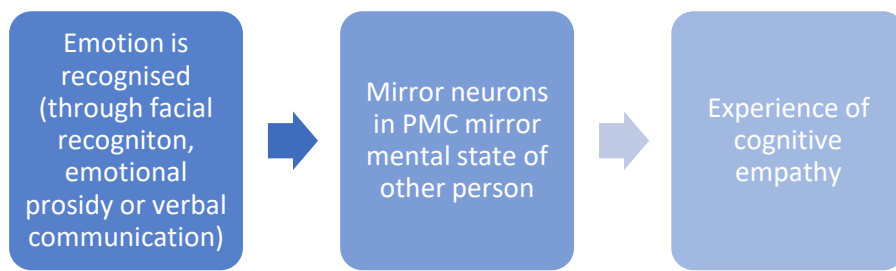
Figure 1: Visualisation of the simulation approach

The theorising approach

The theorising approach claims that people have saved an internal set of rules on how mental states relate to behaviour (Gallese & Goldman, 1998). These rules or theories are acquired during childhood and develop over time (Gopnik & Wellman, 1994). In order to understand someone else's mental state, there should be a theory in place for that specific behaviour. The theorising approach is therefore considered to be more domain specific. A visualisation of the theorising approach is shown in figure 2.
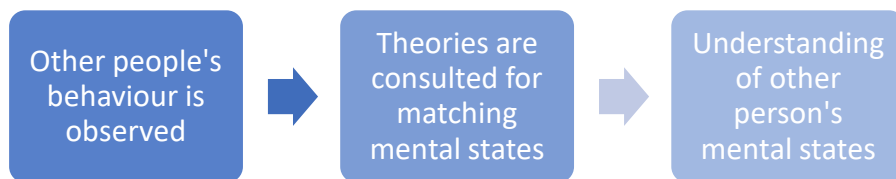

Figure 2: Visualisation of the theorising approach

Neuroscientific models of empathy

Models of empathy have been created, based on the two approaches mentioned above. A first model uses two mechanisms – mirroring and mentalising – to explain empathy (Zaki & Ochsner, 2012). Mirroring is defined as "sharing other's internal states." Mentalising is defined as "explicitly considering other people's internal states." The two processes use two different neural networks. Tasks that require empathy can be biased to either mirroring or mentalizing or can use both. The model can thus be visualised as a spectrum (see figure 3). All processes related to empathy can be placed on this spectrum ranging from mirroring to mentalising. When a process is more related to mirroring, more neural substrates related to mirroring will fire. When a process if more related to mentalising, more neural substrates related to mentalising will fire. A spectrum thus exists between the two tasks. How the two processes exactly relate to the concepts of cognitive -and affective empathy, remains still debated among scholars (Ward, 2017).
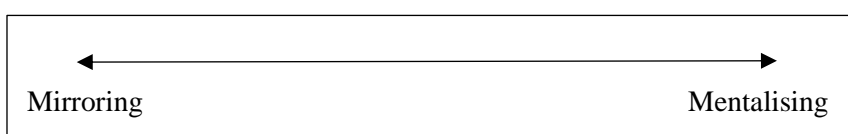

Figure 3: The mirroring-mentalising model by Zaki & Ochser

A second neuroscientific model on the working of empathy in the human brain distinguishes three mechanisms: emotion sharing, emotion understanding and emotion regulation (Decety & Jackson, 2004; Decety & Jackson, 2006; Decety & Svetlova, 2012). Emotion sharing is defined as a simulation based on perception-action coupling. According to this model, though, this function is spread across the brain and not focused on core regions. Emotion understanding implies that people can relate themselves to others, but also are aware that they're a separate individual (Decety & Jackson, 2004). This function is related to networks related to self-awareness, such as the right temporo-parietal junction (rTPJ). Emotion regulation is defined as the capacity to change perspectives and self-regulate. In order to successfully do this, someone must be able to set aside their personal beliefs and knowledge. The empathy model by Jean Decety is shown in figure 4.
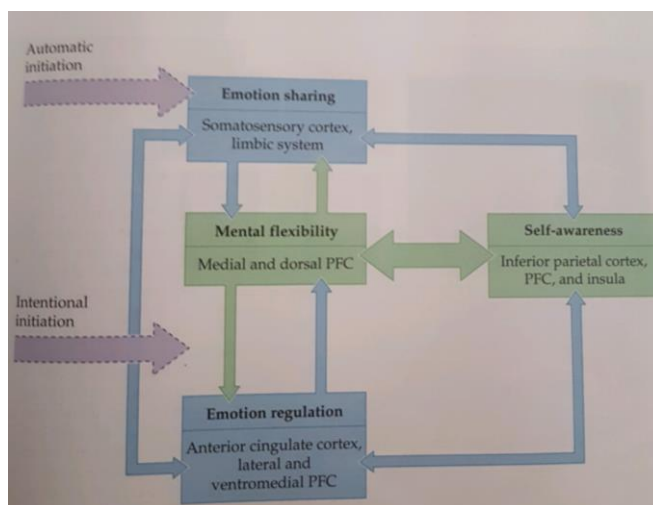

Figure 4: The empathy model by Jean Decety with associated neural mechanisms (Purves, et al., 2013)

From neuroscientific theory, it can be concluded that there is a lot of uncertainty still about the neural nature of empathy. The simulation theory describes empathy as the process of copying someone else's mental state. Theory-theory describes empathy as a set of learnt rules that match behaviour with mental states. Furthermore, models of empathy describe important underlying mechanisms. The mirroring-mentalising identifies two neural networks that underlie all processes related to empathy: one is used for mirroring processes and one is used for mentalising processes. The more biased a process is, the more that network will fire. The empathy model by Decety, describes three mechanisms rather than two: emotion sharing, emotion understanding and emotion regulation. Emotion sharing and understanding are needed for cognitive empathy; Emotion regulation is necessary in affective empathy.

Cognitive theories on understanding others
Next to neuroscientific theories on how empathy works, there's also a body of literature that explains empathy on a cognitive level. This literature comes down to four (social) cognitive factors that influence the experience of empathy in the brain: morality, relationships, identification and prejudice. These factors were found in separate scientific studies on social-cognitive factors influencing empathy. How these factors impact empathy specifically and how they fit in the body of neuroscientific literature will be outlined in this section.

Morality
The first factor is morality. Morality refers to the cognitive task of determining whether certain behaviour is right or wrong. Morality influences empathy in such a way that people can or can't empathise with people based on the social context (Lamm, Batson, & Decety, 2007). This means that they don't feel empathy when doing something that is, in essence, a bad thing, but is considered a good thing because of a bigger goal. An example of the phenomenon is medical practices: cutting someone open is, in essence, a bad thing. However, doing this as a means to achieve a goal that is good, like saving someone's life, ensures that people think the bad means is good. During this process, empathy responses in the brain during surgery are inhibited (Lamm, Batson, & Decety, 2007). This process works the same when watching movies. Killing, in essence, is considered to be a bad thing. However, if the person that is being killed is considered to be the bad guy, people do not empathise with the victim. The phenomenon that morality can alter the self's empathy experience, can best be explained using the empathy model created by Jean Decety (figure 4). In order to determine whether someone or something is good or not, it is important to change perspectives and be aware of the self. Only then it is possible to justify a bad means by using a good cause. Morality thus fits in the model under emotion regulation.

Relationships
A second factor is relationships. Empathy responses in the brain turn out to be more intense when the self is closer to the other (Beeney, Franklin, Levy, & Adams, 2010). This therefore means that it is easier to empathise with someone you know well, than with people you do not know very well. It is thus easier to empathise with a close relative than with a distant friend. How closeness between the self and other influence can be explained by emotion understanding in the empathy model by Decety. This capacity describes the process of relating yourself to others, whilst being aware of your own position. When having a special relationship with the other, it is easier to relate. Moreover, people are more familiar with their position towards the other person. When analysing relationships using the theory approach, one could conclude that relationships influence empathy, because one has acquired more theories about that specific person's behaviour, making it easier to understand them.

Identification
The third factor is identification. Similar to the effect of relationships, the ability of the self to identify with the other determines the degree of empathy the someone experiences. It is thus easier to empathise with people that are considered to be part of the in-group, than with people that are considered to be part of the out-group (Hein, Silani, Preuschoff, Baston, & Singer, 2010; Vanman, 2016). The less two people are alike, the easier it is to dissociate themselves from the other and the more difficult it is to experience empathy. The biggest limiting factor when it comes to identification, is race (Chiao & Mathur, 2010). Many experiments show that people show inhibited neural empathic responses, when presented with a stimulus that had a different race then themselves, regardless of their opinions on the other race. This phenomenon is also known as the empathy gap (Gutsell & Inzlicht, 2012; Chiao & Mathur, 2010). The effects of identification can be explained in a similar way as relationships: when similarities between the self and other are more obvious (ergo they are in the same group), it is easier for the self to relate to the other. The theory approach would explain this by suggesting that one would have stored more theories about people who are similar to the self.

Prejudice
The fourth and final (social) cognitive factor that influences empathy is prejudice. Research suggests that prejudice can lead to false simulation of someone else's emotion in the brain. (Gutsell & Inzlicht, 2010). The effects of prejudice can be explained by the mechanism of emotion regulation. This part of the empathy process requires people to set aside their own personal beliefs and knowledge. This includes prejudice. When beliefs of prejudice are so strong that one cannot set them aside, this will become a barrier for empathising towards people belonging to the group the prejudice is about.

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It can thus be concluded that there are four (social) cognitive factors that influence the degree of empathy felt by someone. By explaining other people's bad emotions are actually morally good, people can switch off empathy in their brain. The closer people are, the easier it is to be empathic towards each other. Identification also influences the degree of empathy: the more similarities there are between two people, the easier it is to empathise. The last factor is prejudice: when someone has prejudice about the other, it can lead to false assumptions about the other's mental state.

Gender differences in empathy

So far, we have outlined how empathy works on the brain and what social cognitive aspects influence the experience of empathy. However, it is important to realise that there are different varieties to how empathy works. In this section the differences between the male and female brain. It is important to consider this information when looking for answers about the impact of smartphones on empathy, as these differences could suggest that this impact may be different for males compared to females.

One remarkable result that frequently arises in studies on empathy, is that men generally are less empathic than women (Trobst, Collins, & Embree, 1994; Schulte-Rüther, Markowitsch, Shah, Fink, & Piefke, 2008; Christov-Moore, et al., 2014). This phenomenon can be explained evolutionary and neurologically. The evolutionary explanation is that, historically women were responsible for taking care of children (Christov-Moore, et al., 2014). Empathy is an important skill for the upbringing of and caring for children (Konrath & Grynberg, 2013).

On a neural level females show more activation in the right inferior frontal cortex and superior temporal sulcus than men (Schulte-Rüther, Markowitsch, Shah, Fink, & Piefke, 2008). These regions are associated with mirror neurons and contagion. Men, however, show more activation in the left temporoparietal junction compared to females (Schulte-Rüther, Markowitsch, Shah, Fink, & Piefke, 2008). This region is associated with dissociation between the self and the other. These findings suggest that men and women have different cognitive strategies when it comes to assessing their own emotions compared to people.

These neural differences can also be seen in empathy performance tasks. It was found that women are both faster (Alaerts, Nackaerts, Meyns, Swinnen, & Wenderoth, 2011) and more accurate (Sokolov, Krüger, Enck, Krägeloh-Mann, & Pavlova, 2011) when it comes to recognising emotional facial expression. Furthermore, females show higher emotional responsivity for affective empathy and engage more emotional areas during social cognition (Christov-Moore, et al., 2014).

It can thus be concluded that men are generally less empathic than women. From an evolutionary perspective, this can be explained by the different cultural roles men and women had over the past centuries. Neural differences are observed: women show more activity in areas associated with mirror neurons and contagion. Men show more activity in regions associated with dissociation between the self and the other. These neural differences show in performance differences in facial recognition.

Conclusion

In this chapter, the neuroscientific and cognitive aspects of empathy were described. First, the two main neuroscientific theories were outlined: simulation theory describes the experience of empathy as a simulation of the other's emotional experience, triggered by emotional cues like facial expressions, prosody and verbal communication. Theory-theory describes empathy as an acquired set of rules that explain the other's specific behaviour. Two empathy models were discussed: the mirroring-mentalising model and the empathy model by Decety. Social cognitive influences of empathy include morality, relationships, identification and prejudice. Differences in the empathic brains of males and females were identified: males are generally less empathic than females, due to neural differences.

Chapter 2: Factors in the empathy experience that are influenced by smartphone use

In the previous chapter, the neurological and cognitive characteristics of empathy were identified. This chapter will use this information to understand how empathy is impacted by the use of smartphones. The question that will be answered in this chapter is: how do stimuli in offline -and online interaction differ and what are the implications for empathy? When answering this question, a few remarks have to be made beforehand. First, the impact of smartphones on empathy can generally be interpreted in two ways: the experience of empathy when interacting through smartphones and the influence of smartphone use on offline interaction. Offline interaction refers to real life, face to face communication, without the use of technology as a medium. In this chapter, both interpretations of the research will be discussed. Second, it is important to notice that online and offline interactions differ in many ways. The main differences, however, can be found in the stimuli that are being perceived during the different interactions. For example, when communicating through Twitter or Whatsapp, one sees the screen of their phone showing text and/or images. When communicating offline, one sees a moving face and body and hearing text. As will be shown in this chapter, these differences in perceptual stimuli can have an effect on empathy processing in the brain. This chapter will therefore focus on the influences of these stimuli on empathy.

This chapter on the influence of smartphone use will proceed as follows: first, an overview will be given of characteristics of smartphones and online communication. Then, a comparative analysis will be done between stimuli during offline and online interaction. This section will also explain how these stimuli influence empathy processing and responses. The chapter will then continue with a discussion of the influence of frequent online communication of offline communication. The chapter will conclude with a short conclusion for this chapter.

Characteristics of smartphones and online communication
Surprisingly, there are not many definitions of the smartphone listed by scholars. Theoharidou, Mylonas and Gritzalis (2012) describe the smartphone as 'a cell phone with advanced capabilities, which executes an identifiable operating system allowing users to extend its functionality with third party applications that are available from an application repository.' This definition thus implies that smartphones use are phones that run on an extensive operating system, similar to personal computers, that is shared so that users can create and share applications. Furthermore, smartphones are characterised by their hardware that is similar to computers, the use and storage of data and the common use of communication (Jeon, Kim, Lee, & Won, 2011; Lederm & Clarke, 2011). This communication can happen via phone, SMS (texting) or social media (like Facebook, Twitter, Instagram or Whatsapp).

All of these means of communication have different features and are therefore used for different purposes. Calling is considered more personal and is therefore most commonly used for business related and emotional conversations. SMS and Whatsapp use directed, generally short text messages to communicate (Sánzez-Moya & Cruz-Moya, 2015). The difference being that Whatsapp allows for group chatting and sharing other files than just text (e.g. photos, videos and audio files). This is similar to Twitter, although this medium is for undirected messages and has a strict character limit of 140 characters (Grabowicz, et al., 2012). Users use certain hashtags with topics related to their text, enabling sorting and searching by topic. Because of its undirected character, Twitter is generally used for public discussion and public relations. Instagram uses the same hashtag system, but photos make up for the primary means of communication rather than words (Hu, Manikonda, Kambhampati, 2014). Instagram posts are however not as public as twitter messages as they are primarily directed towards followers (usually family, friends and acquaintances). Facebook allows for more elaborate messaging (Bachrach, et al., 2012). Facebook uses profiles that consist of personal information and posts containing text, photos and videos. Like Instagram, the readers of these posts are primarily followers.

These new forms of communication come with many opportunities and challenges. Opportunities include direct interaction with people that seemed distant before (e.g. celebrities, businesses, media), easier networking and opportunities for research. Challenges include cyber bullying, spreading fake news and social pressure due to the seemingly perfect lives on the platforms.

Smartphones can thus be seen as advanced mobile phones that use shared operating systems that can be used by users to extend their functions through applications. Characteristics include high capacity hardware (similar to that of computers), the use and storage of data and the common use of communication. This communication takes place using different methods and platforms including calling, texting, Whatsapp, Twitter, Instagram and Facebook. Due to differences in functions, these platforms are used for different purposes. These social media come with many new opportunities (e.g. participation) and challenges (e.g. the spread of fake news).

Texting and talking: a comparative analysis
In the previous section, characteristics of smartphones and online communication were identified. In this section, it is analysed how these characteristics differ from offline interaction and what the consequences are for empathy. These differences are: non-verbal communication, direct feedback, social pressure and anonymity.

Non-verbal communication
A first difference between online -and offline communication is the lack of non-verbal communication. As mentioned in the previous section, online communication applications make use of written text, photo and video (not live broadcasting). These tools do not allow for expressing and seeing non-verbal communication, like body language, prosody or facial expressions (Derks, Bos & Grumbkow, 2008). This information can be achieved through real life, face to face interaction. However, this information is essential for perceiving emotion, understanding emotional states and the experience of empathy (Buchanan, et al., 2000; Goldman & Sripada, 2005). This lack of non-verbal communication could therefore be a cause for inhibition of empathic responses.

Direct feedback
A second difference between online -and offline communication is the lack of direct (visual) feedback. In offline conversations, when performing an action, the consequences of that action will be shown immediately (e.g. people being hurt, getting angry). This immediate response allows for anticipation on the other person's mental state. In online interaction, however, direct responses to action are not a given. People can choose to respond later. This delay of responsiveness can cause less acquisition of theories (according to the theorising approach), between behaviour and emotional states, ensuring inhibited empathy.

Social pressure
A third difference is the between online and offline interaction is the lack of social control. When interacting in real life, especially in a public place, people are watching you. This social control gives a certain social pressure to conform to commonly accepted norms and values, ensuring more empathic responses (as reacting in an empathic way is the norm in many cultures). This social control is actually not available in online private conversations, ensuring people do not have this incentive to reply in an empathic way. The lack of social pressure therefore doesn't inhibit empathy per se, but it does facilitate non-empathic responses.

Anonymity
The fourth and last difference is the option to stay anonymous. When interacting in real life, it is usually not an option to stay anonymous: people can see who you are. This ensures accountability for the actions that someone does. Online, however, many platforms allow for anonymity. This anonymity takes away the accountability, making sure people experience safety. This increased sense of safety ensures people are willing to take more (social) risks. It is therefore possible not to be held

accountable for non-empathic (re)actions. Anonymity therefore doesn't necessarily inhibit empathy, but rather it promotes non-empathic behaviour.

Smartphone use in offline interactions
Now that is known how stimuli of offline and online interaction differ, it is important to find out if and how the use of smartphones impact our ability to empathise during offline interaction. In order to answer this question, the development of empathy should be addressed. When it comes to the development of empathy, there are two approaches, based on the two approaches mentioned in chapter 1: the simulation approach and the theorisation approach (Gallese & Goldman, 1998). The simulation approach assumes that empathy is developed through perceptual learning about emotional cues (e.g. facial expressions, prosody and verbal communication) (Shanton & Goldman, 2010). Theorisation theory assumes that during childhood and adolescence, people acquire theories about the relation of behaviour to mental states (Gopnik & Wellman, 1994). Although different content wise, both approaches assume empathy is developed through social interactions. Although a lot of offline communication is replaced by online communication, it is unlikely that people in everyday life do not have enough social interaction to have develop empathy skills. However, that does not mean it is not possible. Multiple studies do observe lower empathy levels in people with internet addiction disorder (Jiao, Wang, Peng, & Cui, 2017; Melchers, Li, Chen, Zhang, & Montag, 2015).

Furthermore, smartphones can reduce empathic responses during offline interactions in a different way. Since people often carry their smartphone with them and they show notifications whenever there is a message, this can distract the user from the conversation (Aagaard, 2016). This can mean that people miss emotional cues, inhibiting empathic responses in the brain.

The (un)known effects of smartphone use on empathy
Now that is clear how online interaction differs from offline interaction and how the smartphone, even in face to face situations, impact our interaction, the question that remains in this chapter is to what extent effects of smartphone use on empathy are actually observed. First, it should be mentioned that a study done by Konrath, O'Brien and Courtney (2011), found a general decrease in empathy in college students since the year 2000. Because of the big sample size and the long time span of observed data (the oldest data used dated from the 1970s, the newest from the 2010s), it was possible to see a clear differences among decades: participants before the year 2000 showed significantly more empathy than participants after 2000, the scores decreasing by the years. Because of this fairly recent decrease, the authors hypothesised that smartphones could be a potential cause for this decrease in empathy. This hypothesis is however yet to be proven, as no causal relation has been found between normal smartphone use and the decrease of empathy. As previously explained in this chapter, this effect cannot be derived from theory on the development of empathy either.

Even though research hasn't found a causal relationship between normal smartphone use and empathy, there are studies done to related disorders and their relation to empathy. These studies distinguish between Smartphone Use Disorder (SUD) and Internet Use Disorder (IUD). The association between IUD and empathy was more apparent than the association between SUD and empathy (Lachmann, et al., 2018; Melchers, Li, Chen, Zhang, & Montag, 2015). These studies however observe an association, not yet a causal relationship. There therefore is a possibility that low empathy fosters the development of SUD or IUD.

When examining the literature about social media use and its relation to empathy, however, an effect is observed that the contradicts public opinion on online communication and empathy. A longitudinal study conducted by Vossen and Valkenburg (2016) found that social media use could actually enhance empathy capacities in young adolescents. Effects were found for both cognitive and affective empathy. According to the study, social media offers regular opportunities to practice social skills and hence

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increase empathy in those who use it regularly (Vossen & Valkenburg, 2016; Alloway, Runac, Qureshi, & Kemp, 2014). These study also found that even though empathy skills get enhanced by social media, no effects are found for sympathy: the moral emotion related to other people's suffering.

Conclusion

In this chapter, the influence of smartphone use on empathy was examined. It was found that smartphones are cell phones that use shared operation systems than can be used by users to extend its functions through applications. There are many applications that can be used for directed (e.g. text and Whatsapp) and undirected (e.g. Twitter, Facebook and Instagram) communication. All of them use a different way of communication and are therefore used for different purposes. These forms of online interaction have in common with offline interaction that communication takes place using words. They differ from the characteristics of offline interactions in the sense that in online interactions no direct emotional feedback is given, hardly any social control takes places, which normally causes social conformation and people cannot always be held accountable for their actions. It is expected that empathy responses are inhibited in online communication, due to the lack of emotional feedback, social conformation and accountability. How online and offline communication compare, is summarised in figure 5. In offline interactions, smartphone use can inhibit empathic responses as well. However, this process is caused by a lack of attention, rather than the shift towards online communication. In literature, so far, no studies have been done to find a (causal) relationship between regular smartphone use and empathy. However, associations were found between smartphone use disorder and empathy as well as internet use disorder and empathy. Furthermore, it was found that social media use can foster empathy capacities in young adolescents.

Stimuli offline interaction
- Verbal communication
- Non-verbal communication (facial expressions and body language)
- Direct (visual) feedback
- Possible social pressure and/or conformation to social norm
- Usually no anonymity

Stimuli online communication
- Verbal communication
- No non-verbal communication
- No direct (visual) feedback
- Usually no social pressure
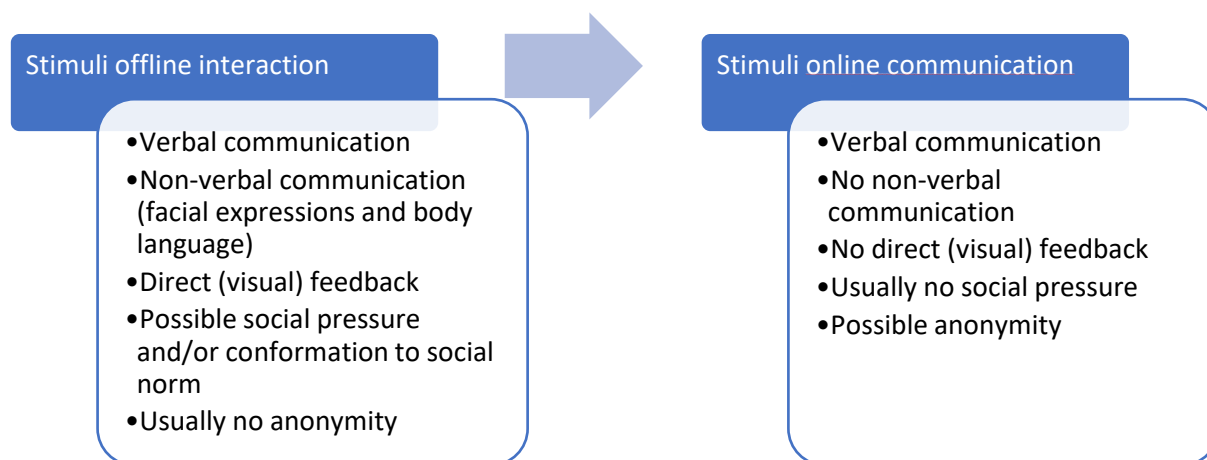- Possible anonymity

Figure 5: Stimuli differences between offline and online interaction

Chapter 3: Intervention methods

So far, it was established how empathy is being processed on a neurobiological and cognitive level, how this process differs depending on different contexts of interaction (online or offline) and how the frequent use of smartphones as communication device can influence empathy experiences. In the previous chapters, it was concluded that smartphone use can indeed have an inhibiting effect on empathy. However, these analyses were done on the current use of online communication through social media, email and texting. In this chapter, it is explored whether it is possible to have applications of smartphone -and social media use to have the opposite effect: enhancing empathy. The question on hand in this chapter will therefore be: how can smartphones and social media contribute to empathy intervention methods aiming to foster empathy in participants?

This chapter will discuss the opportunities for smartphone use in intervention strategies as follows: first, examples will be given of situations in which an increase in empathic responses could be desirable. Second, an overview of existing intervention strategies for increasing empathy will be provided. Third and last, suggestions will be given for how smartphones could contribute to these interventions. The chapter will conclude with a short conclusion for this chapter.

Situations that require enhanced empathy

In society, more and more, people are longing for more empathic behaviour (Conroy, 2017; Hacker, 2013). Many people observe a society that is significantly becoming harder, more competitive and egocentric. Barack Obama once said: "The biggest deficit that we have in our society and in the world right now is an empathy deficit. We are in great need of people being able to stand in somebody else's shoes and see the world through their eyes" (NorthWesternU, 2008). This outcry for a more empathic society also becomes clear from activist social movements (e.g. Black Lives Matter), government campaigns (e.g. #Doeslief) and political parties (VVD, 2019; GroenLinks, 2019).

Apart from a general need for more empathy, there are also more specific situations where enhanced empathy is desirable. An example of such a situation is conflict resolution (de Wied, Branje, & Meeus, 2007) . In such situations, the aim is often to get to an agreement and/or to reconcile. In situations of conflict, an increase in empathy can ensure more leniency towards forgiveness (Toussaint & Webb, 2010; Fincham, Paleari, & Regalia, 2002). Furthermore, empathy can help avoid conflict as studies show that as an increase in empathy can decrease aggression levels (Feshbach & Feshbach, 1969).

A different place where an increase in empathy could be desirable, is the hospital. Numerous studies show that students of medicine show a significant decrease of empathy when partaking in med school (Chen, Lew, Hershman, & Orlander, 2007; Chen, Kirshenbaum, Yan, Kirshenbaum, & Aseltine, 2012; Hojat, et al., 2004). However, empathy is a crucial skill to function socially, especially for physicians: studies show that the empathy of doctors significantly impact the health of patients (Hojat, et al., 2011). Empathy interventions in this field could therefore contribute to both the doctor's and the patient's wellbeing.

A third and last example is that of bullying. Bullying to this day remains a big problem in schools and workplaces and with the invention of online social life, so comes the new problem of cyberbullying. Studies have shown that bullying is related to low empathy (Jolliffe & Farrington, 2006). Empathy enhancement interventions could thus be an effective strategy to decrease bullying in schools, workplaces and online.

In the situations mentioned above, it could be desirable to increase empathy in the people involved. This can be done using empathy interventions. Examples of these interventions are described below. As will be shown later in this chapter, smartphones could play a part in enhancing empathy as well as increasing accessibility to these intervention programs.

Empathy interventions

Research provides a variety of interventions methods to increase empathy in participants. In this section, four of them are highlighted: empathy intervention program by Bayne, INTEMO program, Positive intergroup contact and Empathy games. These four interventions were chosen as they have a significant effect in increasing empathy in participants and they offer opportunities for integration of smartphones. For each of these five interventions the following questions will be answered: *what does the intervention entail?, How does the intervention influence the empathy experience?* and *What part could the smartphone play in this intervention?* This last question will be answered in two directions: *what can the use of smartphones add to this intervention?* and *How can the intervention be applied to online interaction?*

Empathy intervention program (Bayne)

What does the intervention entail?

The empathy intervention program uses experiments, didactics and reflection to stimulate empathy in students of medicine (Bayne, 2011). On the first day of the workshop participants learn about empathy in healthcare through discussions: what it is, the benefits and impact on patients. At the end of the day they apply their knowledge in a fishbowl activity. During the second day, participants are asked to reflect on their empathy towards patients and learn to share emotions themselves, using discussions and roleplay. The results of this method show significant increase in empathy in participants.

How does the intervention influence the empathy experience?

In this intervention, participants learn to mentalise. During the first meeting, using discussions and the fishbowl activity, emotion understanding is targeted and developed. The second meeting focuses more on emotion sharing, as they learn to express and interpret emotion during sharing sessions and roleplay activities.

What part could the smartphone play in this intervention?

- Smartphone in this intervention: none
- Intervention in online interactions: none

INTEMO program

What does the intervention entail?

In this intervention, participants engage in games, role-playing, art projects, film forums and reflection assignments (Castillo, Salguero, Fernández-Berrocal, & Balluerka, 2013). These activities have four aims: (1) to develop accurate emotion perception, appraisal and expression; (2) to create awareness of emotion; (3) to create an understanding of these emotions and being able to have a discussion about them, using an extensive vocabulary; (4) to enhance emotion regulation. Results of this intervention show a significant increase in empathic concern and a decrease in personal distress. No effects were found in perspective taking.

How does the intervention influence the empathy experience?

The aims of the INTEMO program show a clear focus on emotion sharing and emotion understanding (see chapter 1, figure 4). The exercises on emotion perception, appraisal and expression ensured better development of emotion sharing, whereas the exercises on awareness of emotion and understanding and discussion emotion worked towards better emotion understanding. The 4th aim of the intervention implies that there were exercises that worked towards the last component of empathy, emotion regulation, however, these exercises turned out to be not effective as no effect in perspective taking, an important skill within emotion regulation, was found.

What part could the smartphone play in this intervention?

- Smartphone in this intervention: using smartphones during this intervention allows people to take home assignments and develop their empathy skills even further at home. Furthermore,

transposing this intervention to smartphones allows participants to put their learned empathic skills in an online -and digital context.

- Intervention in online interactions: none

Positive intergroup contact

What does the intervention entail?

Positive intergroup contact refers to positive interactions between people who consider each other part of the outgroup (Schellhaas & Dovidio, 2016). By spending time with people from the outgroup, people learn to set aside their own knowledge and beliefs and replace prejudice and stereotypes with empirical knowledge. Doing so, is important in the development of empathy (Vanman, 2016).

How does the intervention influence the empathy experience?

By engaging with people from outside the ingroup, people change their attitude and prejudice about people from that specific group. Also, people start to see similarities between themselves and the other, making it identification easier. This thus relates to the competence of emotion understanding (see figure 4). Furthermore, positive intergroup contact trains people to set aside their own knowledge and beliefs, an important aspect of emotion regulation.

What part could the smartphone play in this intervention?

- Smartphone in this intervention: smartphones make this intervention a lot more practical as it makes it easier to get into contact with people who are not part of the ingroup. Often, people meet each other through games, chat rooms or networking and start having a chat. Online intergroup contact can have the same benefits as offline intergroup contact, without feeling as threatening.
- Intervention in online interactions: none

Empathy games

What does the intervention entail?

Participants engage in digital role-playing games, designed to develop perspective-taking skills (Belman & Flanagan, 2010). The games are based on four principles: (1) players are induced to empathise from the very start of the game (e.g. through instructions or subtle nudging); (2) players should receive specific recommendations about how their actions impact the game; (3) if the goal of the game is to shift someone's knowledge and beliefs, the goal shouldn't just have an emotional empathy aspect, but also a cognitive empathy aspect.; (4) similarities between the player and the other(s) should be shown. Results from this strategy are still unknown.

How does the intervention influence the empathy experience?

The game requires players to mentalise with groups they are usually not familiar with and therefore aims to develop perspective-taking skills, in the model of Decety also known as emotion regulation. It specifically deals with training to let go of beliefs and knowledge about certain groups. Furthermore, it recognises the influence identification has on empathy triggering.

What part could the smartphone play in this intervention? (what can a smartphone add and what can the intervention add to smartphone)

- Smartphone in this intervention: the smartphone has a lot of opportunity to contribute to this intervention. First, due to its multifunctionality, a smartphone can be used as game console. Since more people own a smartphone than a game console, this makes the intervention a lot more accessible. Second, playing empathy games on a smartphone allows for players to be mobile and play anytime and anywhere, making it easier for people to engage with the intervention.

- Intervention in online communication: incorporating the intervention in online communication is a lot harder. An application could be to offer the games as an add-on to social media and online forums. It could be useful to have this add-on in related discussions, so that people take perspective before writing a comment or starting a thread on the topic.

Suggestions for interventions

Based on the knowledge provided in chapters 1 and 2, more suggestions can be given for empathy enhancement strategies. These suggestions will be divided in two parts. The first part will describe possibilities to reduce empathy inhibiting factors of current smartphone use. The second part will introduce suggestions for empathy enhancement.

As can be read in chapter 2, an important factor inhibiting empathy responses is the lack of (direct) feedback from the other to the self. In offline interactions, people get immediate responses to their words and actions, in the form of verbal communication, facial expressions and prosody. This feedback allows for perception-action coupling and simulation in the brain. When interacting through social media, there is a lack of these stimuli, making it harder to empathise. This impairment can be reduced by creating applications that use real-time emotional feedback and send this to the person you are interacting with. An example of such an application could be the use of an avatar or emoji, showing similar visual and auditive stimuli as a human would. A limiting factor of this particular example could be the fact that it is harder to empathise with a virtual character than a real life human.

Another intervention could be the prohibition of anonymity online. As shown in chapter 2, a lot of social media allow for users to be anonymous online. This creates a feeling of safety for users. An effect of this safety is that users cannot be held accountable for their actions, meaning it is easier to show non-empathic behaviour.

Conclusion

In this chapter, opportunities were sought to use smartphones and social media to foster empathy. It was found that modern society has a growing need for more empathic behaviour. Examples of situations in which an increase in empathy could be desirable are conflict resolution, medical school and (cyber)bullying. Five existing intervention methods were analysed: the Empathy Intervention Program by Bayne, the INTEMO program, Positive Intergroup Contact and Empathy Games. Possibilities for smartphone integration have been explored. New suggestions for use of social media and smartphones for empathy intervention were given: live feedback during online interaction and prohibition of online anonymity.

Discussion

In this paper, the relationship between smartphones and empathy has been described and explained from multiple perspectives. First, the debate among scholars about the neurological nature of empathy was explained, the two major theories being simulation theory, that explains empathy as a simulation of brain processes of the other, created by e.g. mirror neurons (Iacoboni, 2009; Kohler, et al., 2002), and theorising theory, that explains empathy as a learned set of rules of how emotion is linked to behaviour (Gallese & Goldman, 1998; Gopnik & Wellman, 1994). On the (social) cognitive level, it was explained that the experience of empathy is influenced by morality (Lamm, Batson, & Decety, 2007), relationships (Beeney, Franklin, Levy, & Adams, 2010), identification (Hein, Silani, Preuschoff, Baston, & Singer, 2010; Vanman, 2016)and prejudice (Gutsell & Inzlicht, 2010). How these neurological and cognitive aspects relate to each other, is probably best explained by the model Jean Decety created. According to this model empathy consists out of three cognitive tasks: emotion sharing, emotion understanding and emotion regulation (Decety & Jackson, 2006; Decety & Jackson, 2004; Decety & Svetlova, 2012).

Second, the nature of smartphones and online communication was explained. Smartphones have the following characteristics: they are mobile phones, they run on shared operating systems that can be used by users to extend their functions through applications, they have high capacity hardware (similar to that of computers) and they use and store data. Online interaction differs from offline interaction in terms of stimuli (such as body language, facial expression and prosody), accountability and social pressure. When applying this information to the knowledge about empathy from chapter one, it becomes apparent that especially emotion understanding and regulation become harder because of this lack of stimuli. It is thus plausible that the use of smartphones for online communication could lead to less empathic behaviour. However, from both simulation theory and theorisation theory, it can be derived that the use of smartphones doesn't affect empathy capacities during offline interaction (Gopnik & Wellman, 1994; Goldman & Sripada, 2005). Studies to the effect of smartphone use on empathy so far mainly span disorders (SUD and IUD), for which has been proven to affect empathy skills (Lachmann, et al., 2018; Melchers, Li, Chen, Zhang, & Montag, 2015). Not much research has been done on the "normal" use of smartphones. However, there are also studies that show that the use of social media can actually improve empathy capacities (in young adolescents) as they offer constant practice opportunities (Alloway, Runac, Qureshi, & Kemp, 2014; Vossen & Valkenburg, 2016). The results of these social media studies and disorder studies in a way seem to contradict each other. The key to this problem seems to be the ways in which the internet (through smartphones) is used as a means of communication.

Since the different ways of smartphone use seems to be the key to whether empathy is inhibited or fostered, it could be useful to use smartphones in empathy interventions. This was done in the final chapter. Four empathy intervention methods were analysed and suggestions were given for the roles the smartphone could play. Furthermore, recommendations were given to mitigate the ways smartphones interfere with empathy during online interactions. These recommendations included adding immediate feedback about the other's emotions during interaction as well as taking away the possibility to stay anonymous, making it possible to be held accountable for one's actions online.

The implications of this study can be categorised into two dimensions: social implications and scientific implications. For society, knowing in what situations smartphones (theoretically) do and don't impact empathy skills ensures more certainty in the public debate. Many of the arguments given in the public debate, were not based in science. This study adds to a more scientifically based debate and more certainty about the impact the rise of smartphones has on our everyday lives. Furthermore, knowledge on the topic means that society can formally and informally anticipate on the consequences of smartphone use on empathy. Empathy inhibiting aspects of smartphone use can be mitigated and positive aspects of smartphones can be amplified. Doing so could help prevent societal problems like

(cyber)bullying. The knowledge on empathy enhancing interventions could help create more effective intervention strategies that can be applied in schools of medicine or conflict resolution.

This study provided an overview of characteristics on multiple levels: cognition, neuroscience, behavioural and interventions. All placed within the context of smartphone use. For psychology, this implicates a contribution to a more clear and powerful conceptualisation of the concept empathy. This fills the knowledge gap that was identified by many of the cited works (e.g. Ravensoft, 1998; Goldman, 1992; Ward, 2017). This knowledge produced in this study adds to the field of artificial intelligence in multiple ways: First of all, this study has set out a number of requirements that are needed for people to experience empathy as well as a more modular overview of the empathy process. This knowledge could contribute to establishing artificial empathy, which remains still a challenge for this field till this day (Asada, 2015). Second, it has become clear from this study how technology can influence our mental processes and behaviour. It is up to society to decide what behaviour is desirable and what isn't. Then it is the responsibility to creators of AI that the technology we use has no negative impact on our behaviour. Third, the knowledge found in this study tells a lot about how humans see technology and how they use it. This knowledge could help improve the user friendliness of new programmes and devices. Lastly, the suggestions made for the role of smartphones in interventions could lead to new kinds of applications for AI. study provides information on person-machine interactions as well as knowledge on empathy, which could be useful in the relatively new field of artificial empathy.

There are however certain limitations to this study. First of all, it must be taken into consideration that conclusions were drawn on the knowledge available at the time of writing. As was mentioned in the text, there are still a lot of gaps in the knowledge, especially when it comes to the neuroscience of empathy. Also, about the knowledge that actually is present on the topic, there is still scholarly debate. An example of this debate is for instance the one between the simulation approach and the theorising approach. All this uncertainty has as a consequence that the conclusions drawn from this knowledge is still relatively uncertain as well. Second, it should be considered that for this research a cognitive -and neuroscience approach has been taken. The answer to the research question has thus been formulated based on research conducted in these fields. There is actually a possibilities that there are factors that fall outside of these fields that could shine a different light on this issue. Examples of other relevant fields that could research this topic are communication sciences and social psychology. The last limitation to this study is the method that is used to answer the research question. This study used a literature review to find out if current cognitive and neuroscientific knowledge could explain the impact smartphones have on empathy. Although this is considered a legit method to answer this question, more experimental research needs to be done to confirm the conclusions that were founded in theory. This will create more certainty about the impact smartphones have on our ability to empathise with others.

The recommendations for future research follow from the limitations in this study. First, it is recommended that the gaps in neuroscientific knowledge on empathy are filled. Examples of these gaps are the ongoing debate between simulation theory and theory-theory (Gopnik & Wellman, 1994; Goldman A. , 1992) and functions of the individual brain mechanisms related to empathy . Furthermore, there needs to be more consensus about the nature of empathy, which could lead to a better conceptual framework. Such a framework could help researchers in the field of neuroscience, but especially scholars outside of this field to better understand empathy as a cognitive process and apply this knowledge in their own fields. As stated above, one of the limits of this study is that it was conducted exclusively from a cognitive -and neuroscientific perspective. It could thus be interesting to take a more interdisciplinary approach to the impact of smartphone use on empathy. A different limitation is the method used in this study. As stated above, no experimental research has been done to the effects of normal (non-disorder) use of smartphones and its effect on the empathy capacities of people. To confirm the conclusions that were drawn from theory in this study, it could be useful to do

more experimental research on the impact of smartphone use on empathy. The research that has been done to the effect of on the one side disorders and on the other social media, could lead to the hypothesis that the effect of smartphone use on empathy depends on the way it is used (Vossen & Valkenburg, 2016; Lachmann, et al., 2018). This raised the question in what situations smartphone use could lead to inhibition on empathic responses and when it leads to an enhancement of empathic responses. The empathy interventions also raise more questions. Examples of questions that are raised in this section are: 'Does the use of smartphones in empathy interventions impact the results of these interventions?' and 'Is it possible to empathise with someone through virtual representations of that person (e.g. avatars or emoji)?' Finally, as stated in the introduction, the public debate about the impact of smartphones is not just focused on empathy, but on social skills in general (Bindley, 2011; Stewart, 2013; Walters, 2015). It is therefore recommended that similar research is done about the impact of smartphone use on other social skills, such as communication and active listening.

Conclusion

The question this study answered is: how is empathy influenced by smartphone use? The study found that smartphone use can inhibit empathy responses, during online communication compared to offline communication. This effect is already observed in participants with internet -and smartphone disorders (Lachmann, et al., 2018; Melchers, Li, Chen, Zhang, & Montag, 2015), however very few studies have been done to this effect with regular use of smartphones. There is however research suggesting that using social media as a medium to communicate, could foster empathic skills (Vossen & Valkenburg, 2016; Alloway, Runac, Qureshi, & Kemp, 2014). These seemingly contradictive results lead to the idea that the effect of smartphones on empathy depends on the way the smartphone is used. The decrease in empathy can be caused by a lack of visual and auditory feedback from the other to the self, making it harder to simulate emotional states and act accordingly (Buchanan, et al., 2000; Goldman & Sripada, 2005). Other aspects inhibiting empathy responses are the lack of social conformity and control and the lack of accountability as a result of anonymity. During offline interaction, smartphone use could inhibit empathic responses by distraction (Aagaard, 2016). However, based on the information found, there is no reason to believe empathy during offline interaction is influenced permanently (Shanton & Goldman, 2010; Gopnik & Wellman, 1994). Smartphones can also be an asset to enhance empathy as they enable more intergroup interaction, emotion understanding development through gaming and provide information (Vossen & Valkenburg, 2016).

Acknowledgements

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