



UNIVERSITY OF PADOVA

Department of General Psychology

MASTER'S DEGREE IN CLINICAL PSYCHOLOGY

Final Dissertation

**Offending and non-offending people with pedophilia:
Executive dysfunctions and structural brain anomalies –
A narrative review**

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ACADEMIC YEAR 2021-2022

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ABSTRACT

This thesis examines the differences between offending and non-offending people with pedophilia in executive functions and brain structures. Pedophilia is a highly stigmatized psychiatric disorder. Offending people with pedophilia are individuals who are diagnosed with the disorder or experience pedophilic interests and have committed sexual abuse against prepubescent children. Non-offending people with pedophilia consist of a subgroup of people sexually attracted to children who have never acted on their attraction or accessed pedopornographic material. Non-offending people with pedophilia are an underrepresented group in research. The thesis aims to investigate whether offending and non-offending people with pedophilia can be discerned by distinct neuropsychological profiles, altered cognitive functions, and brain structures.

Incorporating information from available literature, this study supports the hypothesis that pedophilia per se is not characterized by specific impairments, but rather that offending and non-offending people with pedophilia have neuropsychological and morphological differences that distinguish them and reflect their *modus operandi*. Additionally, this piece of information represents an important tool when developing intervention and prevention projects.

Keywords: pedophilia, executive dysfunctions, child sexual offenders, non-offending pedophiles.

ACKNOWLEDGMENTS

I would like to acknowledge and give my thanks to my co-supervisors Dr. Cristina Scarpazza and Dr. Danielle Rousseau, for their help, time, and kindness. This topic was sometimes controversial and difficult to comprehend, but Dr. Scarpazza's words and suggestions helped me find confidence in my writing. I am thankful to Dr. Rousseau and the months spent at Boston University because her classes allowed me to understand where my true interests reside.

A special thanks to my supervisor Mario Bonato for the trust placed in me when giving me the chance to work on this topic.

I am thankful to Eva and Chiara. Thank you for being my friends, putting up with me, and letting me be part of your life. My day is brightened every time you share your inner world with me.

I am deeply grateful to my mom and dad, who constantly support me through thick and thin. Thank you for believing in me even when I vacillate. I hope you are aware of the great values you have passed on to Dalia and me by simply being yourselves.

I am thankful to my sister Dalia. I couldn't live without you; you are the most important person in my universe. Thank you for listening to me talk about my thesis for hours on end. You make me feel like I can do everything.

INTRODUCTION

Talking about pedophilia can be controversial, for several reasons. Pedophilia is highly stigmatized by the general population, as well as by professionals. Findings show that people with pedophilia (PWP) are sometimes denied the help they need by psychotherapists who deeply misjudge them, and this profound stigma stops PWP from seeking help (Theaker, 2015). Many misconceptions are associated with the disorder, and prejudice and ignorance run deep into people's minds. Pedophilia is a mental disorder found in the *Diagnostic and Statistical Manual for Mental Disorder-5* (5th ed; DSM-5; American Psychiatric Association [APA], 2013), however, most of the population is unaware of its psychiatric connotation. People don't know that individuals with pedophilia do not necessarily abuse children and that people who do abuse them, do not necessarily have pedophilic tendencies. These terms are considered synonyms and deepen the stigma associated with the disorder.

The intent of this thesis is not to justify eventual sexual offenses committed by people with pedophilia but to thoroughly describe the characteristics of this psychiatric disorder and give tools to distinguish offending from non-offending PWP. Some researchers have only recently started studying such differences, and findings useful to delineate the different neuropsychological profiles will be described. Despite the recent effort, there are still too many gaps in this regard, and this leads to a consequent lack of structures and support systems for people with pedophilic preferences who are afraid of harming children.

I believe in the use of empathic words and inclusive language when talking about such delicate topics, and I consider that terms such as "pedophiles" and "offenders" should be substituted. In my thesis, where I have stated my considerations, I have used "people with pedophilia", "people with pedophilic interest", "people interested in prepubescent children" and "people convicted of offenses". Whenever I used the words pedophilia or pedophilic interest, I mean relatively pedophilic disorder and interest in prepubescent children not

recognized as a pedophilic disorder. However, when referring to the cited studies, I used the terms and acronyms that researchers used, such as offenders, “CSOs”, child sexual offenders, “NSOs” for nonsexual offenders, “OSOs” for other sexual offenders, “PED molesters” for pedophilic molesters, and “NPED molesters” for non-pedophilic molesters.

CHAPTER 1

What is Pedophilia?

In this chapter, a first overview of the concept of pedophilia throughout time will be given, to explain how pedophilia and child abuse interrelate and get easily confused. The distinction between pedophilia and child sexual abuse will be clarified, as this distinction helps highlight the difference between offending and non-offending PWP.

The psychiatric connotation that the two classification systems of mental disorders gave of pedophilia will be analyzed, to outline the actual meaning that this term has within the field of psychology.

Environmental, neurodevelopmental, and biological risk factors will be portrayed to better understand the etiology of the mental disorder. Lastly, it will be explained why pedophilic disorder is severely stigmatized, and how deeply the public stigma runs.

1.1. Historical Overview

The term pedophilia comes from the greek “παῖς” (paîs, child) and “φιλέω” (philèò, love), literally love for children. The noted German psychiatrist Richard von Krafft-Ebing coined the term only in 1896 (Syrett, 2020) but relationships of sexual nature among men and children were common since ancient times, as what we now call pedophilia and pederasty. We have numerous Greek writings from the 5th and 4th centuries B.C. that speak of pederasty (Syrett, 2020). Pederasty differs from pedophilia since the definition of the latter is a sexual interest in prepubescent children from 9 to 12 years old, while the term pederasty refers to a sexual interest in pubescent children or adolescents. However, it still signifies a form of erotic and sexual love between a man and a boy (Furfaro, 2004).

During medieval times, having sex with young boys was condemned, but no protection was accorded to little girls, who were given to marriage to very older men (Ames & Houston, 1990).

From the 14th century, children were crowding the streets and served as prostitutes (Ames & Houston, 1990); and up until the 20th century, it was common for heterosexual men to seek the company of young boys as long as they continued to assume a position of dominance and the boys performed submissively (Syrett, 2020).

Today, engaging in sexual practices with children is illegal, although sexual exploitation of children is still a current practice across the world (Benavente et al., 2021). Still, it is essential to clarify that there are relevant differences between PWP and people who do not show pedophilic interest but still engage in sexual activities with children.

1.2. Pedophilia: a Paraphilic Disorder

Pedophilia is denominated by the *Diagnostic and Statistical Manual of Mental Disorder* (5th ed; American Psychiatry Association [APA], 2013) as “Pedophilic disorder”. Pedophilia is considered a paraphilia, and it is indeed included among Paraphilic disorders, one of the categories of the DSM-5 (APA, 2013). According to the DSM-5 (APA, 2013), a paraphilia is any atypical sexual interest defined as intense and persistent. Paraphilic disorders require the paraphilia to cause the individual marked distress or impairments or elicit harm to the self or others (APA, 2013). Therefore, “A paraphilia is a necessary but not a sufficient condition for having a paraphilic disorder, and a paraphilia by itself does not necessarily justify or require clinical intervention” (APA, 2013, p. 686). The diagnostic criteria of pedophilic disorder defined by the DSM-5 (APA, 2013) entail the presence over at least 6 months of intense and persistent sexual arousal behaviors, fantasies, or sexual urges concerning a child or pre-pubescent children (Criterion A); these urges have caused marked distress or triggered the

individual to act on them (Criterion B). Criterion C states that the person must be 16 or older or must have five years more than the child. People with pedophilic disorder can be sexually attracted to only males, only females, or both.

Pedophilic disorder is also included in the *International Classification of Diseases and Related Health Problems* (11th ed.; ICD-11; World Health Organization, 2019), and is categorized as well as a paraphilic disorder. According to the ICD-11 (World Health Organization (WHO), 2019) “pedophilic disorder is characterised by a sustained, focused, and intense pattern of sexual arousal—as manifested by persistent sexual thoughts, fantasies, urges, or behaviours—involving pre-pubertal children. In addition, for Pedophilic Disorder to be diagnosed, the individual must have acted on these thoughts, fantasies or urges or be markedly distressed by them”. If the person does not feel any kind of guilt, shame, or distress, or they have not been functionally impaired by these sexual urges and have never acted on them, they cannot be diagnosed with pedophilic disorder, instead, they have a pedophilic sexual interest (APA, 2013).

The majority of people diagnosed with pedophilic disorder are men (Timm B. Poepl et al., 2015), and their sexual orientation is mostly homosexual or bisexual (Hall & Hall, 2007).

Physically mature individuals elicit less, or equal sexual interest compared to children (APA, 2013).

More than half of people with a diagnosis of pedophilic disorder usually have other psychiatric disorders as comorbidities (Fagan et al., 2002). They are likely to start a physical contact with the subject of their sexual interest (Fagan et al., 2002), and it happens because their interest is intense and persistent (WHO, 2019).

I have not found any reports on the prevalence of pedophilia in the general population. This highlights a societal problem concerning pedophilia.

1.3. Pedophilia and Child Abuse: Differences and Clarifications

The word pedophilia does not have a legal connotation, it is a psychiatric disorder that describes a sexual interest in a child or prepubescent children (Hall & Hall, 2007). As so, according to the dictionary, in the fields of psychiatry, psychology, and criminology, talking about pedophilia is not the same thing as talking about sexual abuse. In a criminological setting, “forcible sexual offense” would be the right term to use (Hall & Hall, 2007), and terms such as “child sexual abuse” or “child molestation” are implemented to address illegal acts (Fagan et al., 2002). Unfortunately, the terms “pedophiles” and “child sexual offenders” are used as synonyms and are therefore considered interchangeable. Even some of the authors of existing literature do not specifically address the psychiatric meaning of the term pedophilia, on the contrary, ascribe to it the meaning of "sexual preference or sexual fantasies toward children" (Cantor & McPhail, 2016, p. 122). Researchers should raise awareness of the importance of distinguishing “pedophilic disorder” from “interest in prepubescent children” and from “child sexual abuse”.

People convicted of offenses against children are individuals who engage in sexual activities with children, but they do not necessarily meet the criteria for a diagnosis of pedophilia (Hall & Hall, 2007). Only a subgroup of them expresses a pedophilic interest or is diagnosed with pedophilic disorder (Jahnke et al., 2015). For example, it is not rare to face the surrogate-type person who abuses a child, someone who uses the child as a surrogate whenever they cannot engage in sexual activity with the desired adult (Beier et al., 2009). This means that the act of abusing a child is not always sexually motivated (Carvalho et al., 2020). At the same time, people with pedophilic disorder do not automatically abuse children, as demonstrated by the second criterion of the DSM-5 (APA, 2013). Surely, pedophilia and sexual abuse are often linked, indeed having a pedophilic interest is one of the main risk factors for child abuse (Jahnke et al., 2015). However, it is useful to distinguish them into two

separate categories (Carvalho et al., 2020), and this distinction highlights the important difference between offending and non-offending PWP.

1.4. Offending and Non-Offending People With Pedophilia

As criterion B of the DSM-5 (APA, 2013) affirms, sexual urges toward prepubescent children cause marked distress or trigger the individual to act on them. Therefore, offending PWP are the ones who fall into the latter statement. On the contrary, non-offending PWP consist of a subgroup of individuals who feel sexual attraction toward children, but have never acted on it, sometimes have no intentions of ever doing so, and have never accessed illegal pedophilic material (Cantor & McPhail, 2016).

It is difficult to define a behavioral or neuropsychological profile of non-offending PWP since most research concerns incarcerated people (Murray, 2000) who committed sexual abuse. Comparing offending and non-offending PWP is still unusual for several reasons. First, some researchers simply compared different groups, like offending PWP with healthy controls, or people convicted of nonsexual offenses. Secondly, it is difficult to find a relatively big sample of non-offending PWP. Non-offending PWP who are willing to come up front or seek help are rare since the disorder is usually ego-syntonic (Bonagura et al., 2022), highly stigmatized (Jahnke, 2018), and people fear possible legal consequences. Therefore, many researchers turned to offending PWP for their studies and used pedophilic assessment measures (phallometric testing, self-reports...) to assess the participants' pedophilic interests, despite knowing that people convicted of offenses against children do not necessarily have a pedophilic disorder or a sexual preference toward prepubescent children.

In the field of treatments and prevention programs, treatments have been used to prevent recidivism among offending PWP and have mostly focused on cognitive-behavioral therapy (CBT), while prevention programs have been recently developed to prevent child sexual

abuse and help people who fear harming a child, like The Berlin Prevention Project Dunkelfeld (PPD) (Beier et al., 2009) and the “Help Wanted” program, based in the United States (Shields, Letourneau, et al., 2020), (Cantor & McPhail, 2016).

1.5. Etiology of Pedophilia

The disorder's etiology is still unknown, but the DSM-5 (APA, 2013) affirms that multiple factors could be accountable for its development. The most relevant studies related to genetics, neurodevelopmental, and environmental factors will be addressed.

1.5.1. Genetic Factors

According to the genetic approach, pedophilia is caused by candidate genes, and it runs in families, more than other paraphilias (Gannon, 2021). Studies on monozygotic and dizygotic twins corroborate this theory since there is a higher incidence of pedophilia for monozygotic twins (Alanko et al., 2013). In 1984, Gaffney et al. conducted a small study on familial transmission of pedophilia, and the results showed that more than 10% of the surveyed patients had male first-degree relatives with the same disorder (Gaffney et al., 1984). The results were supported by a different study run in 2012. Still, the researchers of this study did not manage to clarify whether the results were attributed to the shared environment or genetics (Berryessa, 2015). A case study on monozygotic twins seemed to demonstrate that the development of pedophilia is more influenced by genetics rather than environmental factors (Shim et al., 2014). However, other scholars have suggested that it could be explained by a genetically determined susceptibility to environmental factors (Berryessa, 2015) and case studies are not very reliable.

Candidate genes have been studied as well (i.e., Alanko et al., 2016). Alanko et al. (2016) examined single nucleotide polymorphism (SNP), and other researchers focused on variable

number tandem repeats as well as on SNP, but both studies were inconclusive (Gannon, 2021).

1.5.3. Environmental Factors

One factor that seems to play a key role is the person's own experience of being a victim of child sexual abuse (Fagan et al., 2002). People who have been sexually abused show greater sexual arousal toward children (Seto & Lalumière, 2001) and more pedophilic tendencies when answering the SSPI (Screening Scale for Pedophilic Interest, Seto & Lalumière, 2001) (Gannon, 2021). These findings have been of empirical support to the *sexually abused abuser hypothesis* (Seto et al., 2010) which specifically indicates that those who experienced sexual coercion are more prone to perpetrate it. Seto et al. (2010) conducted a study on Swedish and Norwegian males demonstrating that there is a strong association between having been coerced and the act of coercing in the general population. However, child sexual abuse does not always involve force because people who abuse children usually prefer gaining the child's trust over using coercive acts (Kohli, 2004). Aebi et al., (2015)'s findings emphasized the relationship between past abuses, with or without contact, and the future tendency to abuse and sexual offending. Scholars supporting social learning approaches "assume that pedophilia becomes internalized and abusive" (Gannon, 2021, p. 4). This theory is usually linked with classical and operant conditioning, which could explain both the origin and maintenance of the paraphilic disorder (Gannon, 2021).

A remote risk factor for the development of pedophilic tendencies is an inadequate attachment style between the child and the caregivers (Fagan et al., 2002). In general, adverse childhood experiences, such as parental neglect, increase the likelihood of the expression of pedophilic disorder (Alanko et al., 2013).

1.5.4. Neurodevelopmental Factors

The neurodevelopmental hypothesis states that pre-, peri-, or post-natal perturbations may have disrupted the normal development of the brain, increasing the risk of developing a pedophilic interest (Eastvold et al., 2011). Research showed that many neurodevelopmental factors are linked to pedophilia, and these factors could be present from early childhood or could develop during adolescence (Abé et al., 2021).

Research has highlighted a strong relationship between pedophilia and left-handedness preference (Blanchard et al., 2007), short stature (Cantor, Klassen, et al., 2005), reduced volume of the amygdala, and reduced white matter (Becerra García, 2009), serious self-reported head injuries (Blanchard et al., 2003), and a lower IQ (Abé et al., 2021). Other neuropsychological deficits refer to impairments in attention and executive functions, such as response inhibition (Abé et al., 2021) and information processing (Tenbergen et al., 2015).

The study of handedness seems to be quite relevant to the field. The first applicable data on it were collected by Bogaert (2001). He found that adults who abused children under the age of 12 showed higher rates of non-righthandedness (Bogaert, 2001). Left-handedness slightly negatively correlates with verbal IQ and the WAIS (O'Boyle & Benbow, 1990); moreover, conditions associated with neurodevelopmental problems show reduced right-handedness (Cantor et al., 2004). Handedness develops very early in life and usually does not change over the years, therefore evidence of left-handedness among most pedophilic men connects pedophilia to early neurological perturbations (Cantor et al., 2004). Most of the studies that focused on executive functions among pedophilic men used the Edinburgh Handedness Inventory (Oldfield, 1971) to measure handedness, however, the Chapman Handedness questionnaire (Chapman & Chapman, 1987) was a common measure as well. Both tests provide a handedness index instead of dichotomizing it (Dodd, 2016). Since Bogaert's results, more and more researchers decided to investigate the correlation between

pedophilia and left-handedness. A study conducted by Cantor et al., (2004) supported the correlation between left-handedness and both pedophilia and hebephilia, despite observing that it was influenced by the age variable. The authors, however, did not stipulate the proportion of non-right-handed people, and this is why Cantor, Klassen, et al. (2005) carried out new research to address it. They conducted two studies. Study 1 showed a significant correlation between non-righthandedness and greater phallometric response to prepubescent children, but no association with the number of prepubescent victims. On the other hand, the victim's history can be easily misinterpreted, since sexual preference is just one of the many factors that can influence it (Cantor, Klassen, et al., 2005). In Study 2, handedness data were collected through a dichotomous item, "Which hand do you write with?". Pedophilia and non-righthandedness were tightly linked, equally or more than any other neurodevelopmental disorders. The study, however, was correlational and did not allow to make a distinction between a natural tendency to left-handedness and a pathological non-righthandedness (Cantor, Klassen, et al., 2005).

Concerning head injuries, Blanchard et al. (2002) wanted to understand their association with pedophilia. 413 participants were identified as pedophilic, and 793 as non-pedophilic. It seemed that head injuries might be associated with both lower intelligence levels and pedophilia if such injuries occurred before the age of 6 (Blanchard et al., 2002). The authors concluded that there can be two different interpretations of this association: either head injuries enhance the risk of pedophilia, or a third variable increases the risk of developing the disorder and makes the person more susceptible to head injuries. This study supports the neurodevelopmental hypothesis (Blanchard et al., 2002). Nonetheless, the number of reported head injuries experienced by pedophilic men was very high, which made the authors wonder whether the subjects used head injuries as a scapegoat for their atypical sexual tendencies (Blanchard et al., 2002).

Blanchard et al. (2003) developed a new study that, once again, aimed to better understand the association between head injuries and pedophilic behavior. Subjects were ultimately 428 males who had experienced atypical sexual behavior and had committed one or more sexual offenses. Phallometric testing was conducted to determine the subjects' preferred erotic gender and age. Results evidenced that head injuries before the age of 13 correlated with pedophilic tendencies, left-handedness, and attentional problems (Blanchard et al., 2003).

It must be disclaimed that most of the research conducted on these topics focused on offending PWP (Gannon, 2021).

1.6. Stigmatization of Pedophilia

As it is known, mental illness is highly stigmatized by the general population (Krendl & Freeman, 2019). The reasons behind this stigma extend widely, and the media does not help. People usually come to know about mental illness through content shown by the media, such as movies that depict people with mental disorders as extremely dangerous (Krendl & Freeman, 2019). Moreover, when magazines and newspapers report a case of child abuse, they often speak of pedophilia, increasing the confusion between terms. In addition, they commonly refer to "pedophiles" as monsters, spreading misinformation and prejudice.

Jahnke, Imhoff, et al., (2015) have conducted two comparative studies to determine how deep the public stigma toward people with pedophilic tendencies runs. They compared it with other mental disorders, such as alcoholism, sadism (paraphilic disorder), and antisocial personality disorder. The studies demonstrated that PWP were highly stigmatized, and their group was the one most associated with very negative emotions compared to people with other mental disorders. Participants were also told that no law was transgressed by them, thus that no abuse had ever occurred. One more interesting piece of information attained by this

study is that participants believed that PWP were in control of their sexual interests (Jahnke, Imhoff, et al., 2015). This assumption contrasts with scientific evidence, which clarifies that pedophilia is not a choice (Seto, 2008). Moreover, people tended to immediately link pedophilia with child sexual abuse (Jahnke, Imhoff, et al., 2015).

Disconcerting is that Jahnke, Philipp, et al., (2015) surveyed a German sample of psychotherapists and discovered that many of them were not willing to counsel people diagnosed with pedophilia, because of the negative stereotypes and prejudices that they attributed to them. This proves that the stigma is deeply radicalized in each individual, regardless of someone's personal or professional knowledge.

CHAPTER 2

Assessing Pedophilia

Valid assessment measures are necessary to diagnose and study pedophilia (Seto, 2008). Many different single and complementary measures are being used, such as self-reports, psychophysiological measures, (Carvalho et al., 2020), and neuropsychological methods (Massau et al., 2017). In this chapter, the most used assessment methods will be described.

2.1. Psychophysiological Assessment

Psychophysiological methods assess psychophysiological changes in the body, such as variations in blood pressure, electrodermal activity, and respiration (Dirican & Göktürk, 2011). They represent indirect measures that infer the subject's cognitive and affective state (Dirican & Göktürk, 2011).

2.1.1. Phallometric Testing

Penile Plethysmography (PPG) is an objective measure of sexual arousal (Freund, 1965). Sexual or neutral stimuli are presented to the subjects while using a device to detect penile tumescence in response to the stimuli (Gosselin & White, 2021). Today three different devices exist, two of them measure the circumferential changes, while one of them detects changes in the volume (Marshall, 2014). The latter was first developed by Kurt Freund in the '50s, then Bancroft et al., (1966) developed a rubber strain gauge, the most commonly used device today (Carvalho et al., 2020).

The kind of presented stimuli varies, and in the context of pedophilia, may include audio-only, videos or photos of clothed or unclothed children, and adult/child interactions (Carvalho et al., 2020). The choice concerning the kind of presented stimuli is one of the factors that determines the validity of the test (McPhail et al., 2019). Slides-only and audio plus slides modalities both have strong validity, while audio-only stimuli don't (McPhail et al., 2019).

Using slides of nude children is considered controversial for ethical reasons (Gosselin & White, 2021) and it is authorized just in some countries (Carvalho et al., 2020), even though it strongly predicts pedophilic interest and sexual recidivism (McPhail et al., 2019). To solve this debate, researchers decided to use virtual people sets, pictures of humans created by computers (Dombert et al., 2017).

Although considered the gold standard assessment method, it has its limitations. Procedures are not standardized, there are no protocols for either the scoring or the implementation of the device, therefore assessments diverge from site to site (Laws, 2009). Moreover, both PWP and people convicted of offenses against children have learned to fake patterns of sexual arousal to some degree (Chivers et al., 2013). This is why the PPG is used in combination with other assessment methods (Hsueh et al., 2003).

2.1.2. Polygraphy

The polygraph is a device that assesses psychophysiological changes in the body, such as changes in heart rate, skin conductance, blood pressure, and respiration (Seto, 2008). These factors are being measured while the subject is asked questions about their sexual preferences, and specific changes should determine whether they are lying or not. This method is generally used to confirm the validity of self-report answers (Seto, 2008).

2.2. Self-reports

Self-reports are subjective measures through which clinicians directly ask the involved individual about their thoughts, fantasies, and personal experiences. Self-reports include questionnaires or clinical interviews, and they are particularly useful when subjects don't deny their sexual interests (Seto, 2008). This is sometimes the case because participants could feel ashamed or fearful of exposing themselves to clinicians or may fear possible consequences (Carvalho et al., 2020). This is the perfect method to understand and investigate

the individual's subjective experience, but in no situation, self-report measures alone should be used to assess pedophilic preferences (Carvalho et al., 2020).

The Screening Scale for Pedophilic Interest (SSPI; Seto & Lalumière, 2001) is an example of a self-report measure. It is a screening method of four items initially developed as an alternative method when phallometric tests were not applicable (Seto & Lalumière, 2001). The scale was created for adult males who had already committed at least one sexual abuse against a child. According to Seto and Lalumière (2001), the likelihood of pedophilic tendency increases if the individual's victims are multiple, are males, are not related to the individual, and if they are pre-pubescent children. The SSPI-2 is a new revised version (Seto et al., 2017) developed as a screening method for pedophilic interests in both prepubescent and pubescent children among men older than 18 years old. What distinguishes the SSPI from the SSPI-2 is the addition of a new item related to child pornography (Seto et al., 2017). The items are presented in [Table 1](#). The SSPI-2 is positively correlated to greater arousal responses during phallometric testing, sexual concern, convergent validity, and emotional connection to children (Seto et al., 2017). The validation of the SSPI-2 has overcome the SSPI, which is why the authors recommend using the revised version (Seto et al., 2017).

Table 1

The Screening Scale for Pedophilic Interest – Version 2 (SSPI-2)

Items	Yes	No
Any boy victim under the age of 15		
Multiple child victims under the age of 15		
Any child victim under the age of 12		
Any extrafamilial child victim under the age of 15		
Any possession of child pornography		
Total		

2.3. Neuropsychological Assessment

Neuropsychological assessment evaluates the cognitive functioning of the brain while being exposed to child-related stimuli (Harvey, 2012). If someone has a pedophilic preference, the presentation of child-related stimuli should interfere with executive functions.

As already said, self-reports and psychophysiological assessments have their limits (Carvalho et al., 2020; Chivers et al., 2013; Laws, 2009), therefore neuropsychological indirect measures have been developed to deal with fake responses.

2.3.1. Implicit Association Test (IAT)

This indirect measure aims to assess implicit associations between the terms children and sex, in comparison with adult-sex associations (Gray et al., 2005). Research supports the ability of the test to demonstrate such associations, and to discriminate preferred ages (Carvalho et al., 2020).

The IAT has great potential in both clinical and forensic settings since such associations are hardly controllable by the subjects (Gray et al., 2005) until they realize what the variable of interest is (Carvalho et al., 2020). Moreover, the range of its specificity and sensitivity is as good as the PPG (Carvalho et al., 2020).

2.3.2. Viewing Time Paradigm (VT)

The neuropsychological field has started using reaction time to determine a pedophilic sexual interest (Mokros et al., 2013). Theoretically, PWP show longer reaction times (RTs) to child-related stimuli, because of a processing bias for such stimuli, and *viewing time* is an experimental paradigm developed to assess this processing bias (Mokros et al., 2013). The VT measures the amount of time that a participant looks at different images, assuming that people with pedophilic interests record a longer viewing time with pictures of children compared to non-pedophilic control groups (Mokros et al., 2013). Recent studies showed that the VT has a moderate validity in assessing pedophilic tendencies and discriminating between people

convicted of offenses against children and people convicted of non-sexual offenses, and a significant convergent validity with other assessment measures (Schmidt et al., 2017). The VT is preferred to other neuropsychological methods, such as the IAT (Schmidt et al., 2017). The authors of the study (Mokros et al., 2013) explicitly said that pedophilic interests among individuals who abused children were assessed through the VT, but since this group was not exclusively pedophilic (Schmidt et al., 2017) results must be taken with a grain of salt (Mokros et al., 2013).

2.3.3. Choice Reaction Time (CRT)

Another paradigm that uses reaction time to assess pedophilic preferences is the Choice Reaction Time (CRT). It is an attentional-based method, that measures the allocated attention to specific stimuli when there is a concurrent cognitive task (Mokros et al., 2010). This task assumes that responses to meaningful stimuli are slower in comparison to non-relevant ones (Geer & Bellard, 1996), therefore reactions to the concurrent cognitive task are delayed if participants have pedophilic tendencies and the stimuli are children-related (Mokros et al., 2010).

Mokros et al. (2010) were the first ones to assess pedophilic interests through the CRT. Results showed that, in general, participants took longer to respond to sexually explicit stimuli. Moreover, research gave evidence that people who sexually abused children had longer RTs when the presented stimuli represented a child rather than an adult. However, the sample was small (Mokros et al., 2010). Another study by Dombert et al. (2017) confirmed that stimuli of the preferred sexual object elicit longer RTs. However, the study showed that its discriminant validity was poor to moderate, similar to other neuropsychological methods, such as the IAT (Dombert et al., 2017).

2.3.4. The Rapid Serial Visual Representation Task (RSVRT)

This task measures the phenomenon called *attentional blink* (AB), which occurs when individuals are exposed to stimuli considered salient by them (Carvalho et al., 2020). The stimuli increase the level of attention that the participant reserves for them, and consequently decrease the ability to detect the following stimulus when presented in close temporal succession (Martens & Wyble, 2010). In a sample of PWP, it is expected that the AB will increase when the first stimulus involves a child (Carvalho et al., 2020). However, results did not completely support this theory, and new research is needed (Carvalho et al., 2020).

2.3.5. Oculometric Measures

Eye-tracking has been used to study sexual preferences, as it gives information on initial attention and maintenance of attention when child-related and adult-related stimuli are presented (Godet & Niveau, 2021). Although it seemed promising, research on it hasn't received much recognition (Carvalho et al., 2020).

CHAPTER 3

Executive Functions and Pedophilia

As already said, PWP can be differentiated into two subcategories: the ones who act on their sexual interest and the ones who don't, making them respectively offending and non-offending PWP. Most studies have thoroughly analyzed the differences between pedophilic people convicted of offenses against children, healthy controls, and/or people convicted of non-sexual offenses. It is only in recent times that the literature on PWP who have not committed sexual offenses (P+CSOs) is expanding (i.e., Lett et al., 2018; Massau et al., 2017; B. Schiffer et al., 2017), while before, this group of people was underrepresented (Jones et al., 2021). From a cognitive perspective, researchers have carried out studies to understand what distinguished PWP from the general population. They were first interested in global intelligence, but research got more specific and ended up focusing on distinct executive (dys)functions concerning pedophilia.

3.1. Executive Functions: Batteries, Tests, and Scales

The first studies related to the field mainly focused on global intelligence. Researchers' goal was to understand whether pedophilic people convicted of child abuse had a lower intelligence quotient (IQ) compared to people convicted of nonsexual offenses and healthy controls. The IQ score gives information on the individual's cognitive function in verbal and non-verbal tasks (Christie, 2005). Many batteries have been developed to measure the IQ, the most common one is the Wechsler Adult Intelligence Scale (WAIS; Wechsler, 1955, 1981, 1997, 2008a). The core functions that the test assesses are verbal comprehension, visual organization, perceptual ability, attention, and concentration, from which derives a global IQ score (Christie, 2005). Authors later realized that the results attained from these studies were not representative of the pedophilic population, and decided to emphasize more specific

executive functions, to delineate a neuropsychological profile. In some studies, the participants' IQ matched and was considered a covariate of no interest (Massau et al., 2017). This new line of research has highlighted some differences among PWP in response inhibition, working memory, visuospatial ability, planning skills, attention, processing speed, and cognitive flexibility (i.e., Suchy et al., 2009; Eastvold et al., 2011). Visuospatial ability is described by Yang et al. (2014) as the skill of processing "visual information that involves spatial relations" (Yang et al., 2014, p. 2). Processing speed means measuring the number of tasks that a participant solves while given a period, or the amount of time they take to solve a simple task (Doebler & Holling, 2016). Batteries and tests that assess these abilities are the Corsi Block-Tapping test (Schellig, 1997), used to assess visuospatial ability and working memory capacity, and the d2 Attention-Deficit Test (Brickenkamp, 1994) to evaluate attention and processing speed. The Tower of London (Schall et al., 2003) was often used for planning skills, which are connected to impulsivity. Response inhibition as well is related to impulsivity, and it entails impulsive reactions to stimuli without thinking about the consequences (Rosburg et al., 2018). Stop-signal and go/no-go tasks are usually utilized to assess this function (Congdon et al., 2012). Go/no-go tasks require participants to respond to one set of stimuli and to avoid responding to a different one, then an index of errors is imparted; while the Stop signal requires individuals to inhibit a response that was already initiated (Congdon et al., 2012). Cognitive flexibility is the ability to adapt to changing contingencies or tasks (Deak & Wiseheart, 2015) and it is commonly measured in laboratory sites using set-shifting paradigms (Dajani & Uddin, 2017). The Wisconsin Card Sorting Task (WCST) (Grant & Berg, 1993), and the Trail Making Test Version (TMTV) (Broshek & Barth, 2000) are common measures of set-shifting ability (Roberts et al., 2007). To assess these skills, some subtests were also taken from the Cambridge Neuropsychological Test Automated Battery (CANTAB) (Cambridge Cognition Ltd, 2011).

Age, education level, and global intelligence were then considered variables that participants should match.

3.2. Executive Functions: Studies on Offending People With Pedophilia

Blanchard et al. (1999) first studied the interaction between cognitive functioning, parental age, and atypical sexual behavior and preference. The study was conducted on 678 people who offended children and 313 people with gynephilia¹. The authors identified as pedophilic people who had never abused women or men over the age of 16 and 17 respectively but had committed two or more offenses against someone younger, and one of the two children they offended had to be younger than 11 years old. Data were collected through distinct sources: semi-structured interviews on the subject's history and clinical ratings of their intelligence, the patient's clinical chart, self-administered questionnaires, and phallometric testing. Semi-structured interviews had been previously administered by Kurt Freund at the Kurt Freund Laboratory. Kurt Freund used the interviews to classify participants according to their intelligence, and some of the patients were identified as retarded or borderline. The new data were then integrated with the existing data. The group of pedophiles was divided into three categories: homosexual pedophiles, bisexual pedophiles, and heterosexual pedophiles. The authors observed that gynephilic people and heterosexual PWP were more intelligent than bisexual and homosexual PWP. Moreover, lower IQs were linked to greater interest in younger children and male children, and PWP with a lower IQ were more likely to approach their victims (Blanchard et al., 1999).

The study had distinct limitations: data were previously collected for a different purpose, the authors did not use standardized IQ scores, and the participants' offense history was not collected through official police reports but accessed via self-reports (Blanchard et al., 1999).

¹ Sexual interest in women.

Nevertheless, the first weakness reduces the presence of biases, and the large sample offsets random errors (Blanchard et al., 1999).

As was previously stated, Blanchard et al. (2003) observed that head injuries before the age of 13 correlated with pedophilic tendencies, left-handedness, and attentional problems (Blanchard et al., 2003).

In 2004, Tost et al. assessed the neuropsychological profile of four males who met the DSM-IV (APA, 1994) criteria for pedophilic disorder. Three of the four participants had sexually abused a child (Tost et al., 2004). The authors evaluated functions related to the frontal part of the brain, such as response inhibition, working memory, abstract reasoning, and cognitive flexibility, and those considered “non-frontal”, such as visuospatial memory, global intelligence, and phasic alertness. Participants showed relevant weaknesses in the frontal tasks, while their performance was within the normal range in non-frontal tasks. Findings are promising but must be carefully interpreted because of the extremely small sample (Tost et al., 2004).

A link between pedophilia and low intelligence was also demonstrated by a study carried out in 2004 by Cantor et al. 48 participants were part of the pedophilic group, 161 were classified as hebephilic, and 95 as teleiophilic. To assess intelligence and executive functions, researchers used the WAIS-R (Wechsler, 1981) and two brief memory tests (Cantor et al., 2004). Handedness was measured with the revised version of the Edinburgh Handedness Inventory (Oldfield, 1971; Williams, 1986). The individual was categorized as pedophilic if responded more to prepubescent children during the phallometric testing or if he claimed a greater interest in children (Cantor et al., 2004). The same results and effect sizes were obtained when covarying current age and age when learning English as a second language, showing significant differences between groups, with the pedophilic group scoring the lowest in the WAIS-R (Cantor et al., 2004). No significant difference was found in memory testing

when controlling the IQ (Cantor et al., 2004). Statistical analyses supported the findings and showed a correlation between left-handedness and both pedophilia and hebephilia, but the authors found that handedness was highly influenced by the age covariate. Executive functioning was negatively correlated with a greater penile response to prepubescent children, and more specifically, to the number of offenses against children under 12 (Cantor et al., 2004). The greatest limitation of this study is its categorical approach, through which authors assigned individuals to distinct categories (pedophilic, hebephilic, and teleiophilic).

Cantor, Robichaud, et al. (2005) conducted a quantitative reanalysis of data regarding the IQ of people convicted of sexual offenses. The sample was chosen by using a computer-assisted literature search. In total, the sample included 7,045 people convicted of sexual offenses and 18,101 comparison participants. First, 165 adult samples were compared based on their offense status as convicted people or non-convicted people, and results showed that the sample of people convicted of sexual offenses had the lowest IQ score (Cantor, Robichaud, et al., 2005). Then, people who abused children and people who abused adults were differentiated, demonstrating that the first group scored the lowest. Therefore, a low IQ was specifically linked to pedophilic convicted men, and the younger were the victims, the lower the IQ (Cantor, Robichaud, et al., 2005). Authors sustain that differences in previous studies can probably be attributed to the number of actual pedophilic people present in each sample (Cantor, Robichaud, et al., 2005).

In a study carried out in 2007, Blanchard et al. assessed the subjects' sexual interest with a phallometric test and their IQ with six subtests of the WAIS-R (Wechsler, 1981). The study aimed to understand whether the association between lower IQ and pedophilia was artifactual (Blanchard et al., 2007). 106 men were identified as pedophilic, 340 as hebephilic, and 386 as teleiophilic men. Individuals who had multiple offenses against prepubescent children were considered pedophiles. Pedophilic men were recruited by being referred by their lawyers,

parole or probation officers, or other individuals. The results confirmed that pedophilic men had a lower IQ, but the foremost finding is that the three subgroups of pedophilic men had similar IQ scores. Therefore, the authors concluded that the association between pedophilia and low IQ is not artifactual but rather truthful to the facts. This finding supports the theory that a sexual interest in prepubescent children may be caused by neurodevelopmental perturbations (Blanchard et al., 2007).

Suchy, et al. (2009) conducted a study with 20 offending men with pedophilia, 20 men convicted of sexual offenses without pedophilia, and 20 male controls. Phallometric testing and self-reports were used to identify the preferred erotic gender and age. Data on neurologic vulnerabilities were collected through self-reports, and the neuropsychological assessment included measures of semantic knowledge (SK), executive functions (connected to frontal lobe pathologies), auditory and visual memory, processing speed (PS), and motor speed (MS). Some of the instruments the authors used were the SSPI, some subtests from the Shipley Institute of Living Scale – Revised (SILS; Zachary, 1981) to assess intelligence and SK, the Handedness Questionnaire, and some tests from the WAIS-III to measure SK, PS, and MS (Suchy et al., 2009). The authors also investigated the presence of neurodevelopmental perturbation, and mental or medical illnesses through the Health Screening Questionnaire. Both pedophilic and other convicted people showed weaker executive functions, but problems in PS emerged only in pedophilic convicted people who abused children, and weaknesses in SK only among non-pedophilic men. It is difficult to explain the weakness related to PS, which is usually associated with lower IQs and brain injuries that they did not have. The weakness might reflect the attempt by those with pedophilia to hide their sexual attraction, which made them increase their level of self-monitoring and, consequently, have slower PS. No significant differences were identified for auditory and visual memory. The Health Screening Questionnaire pointed out higher rates of learning disability (LD) in both groups,

however, the cognitive weaknesses within the group of people who committed offenses against children (either pedophilic or not) were present regardless of the presence of an LD. The authors realized that the presence of an LD could explain why the group of non-pedophilic convicted people were less educated and performed worse in SK, but since higher rates of LD were identified in both pedophilic and non-pedophilic convicted people, LD alone cannot explain the deficit in SK. Suchy et al. (2009) sustain that something similar could have happened to other researchers with offending PWP samples, and it could elucidate why previous studies showed an overall lower IQ (i.e., Cantor, Robichaud, et al., 2005; Blanchard et al., 2007). The study presents serious limitations, such as the use of experimental paradigms to assess PS and MS, which makes the results incomparable to standardized norms (Suchy et al., 2009). The sample was very small and made of convicted people, a different, bigger sample could have shown different outcomes. Lastly, data on neurologic vulnerabilities were collected through self-reports, which are not completely reliable (Suchy et al., 2009).

PWP can show a preference toward prepubescent boys, girls, or both (APA, 2013). Kruger & Schiffer (2011) sought to understand whether PWP exhibit different profiles of executive functions related to their preferred gender. 20 forensic males with a diagnosis of pedophilic disorder (DSM-IV, APA, 1994) were included in the sample and compared to 28 healthy controls (Kruger & Schiffer, 2011). Of the 20 forensic males, nine were attracted exclusively to females and 11 to males. Confounding factors such as education level, age, and gender orientation were controlled to understand their influence (Kruger & Schiffer, 2011). Assessment measures included the reduced Wechsler Adult Intelligence Scale (WIP) (Dahl, 1986), the WCST; the Corsi Block-Tapping test, and the d2 Attention-Deficit Test (Kruger & Schiffer, 2011). PWP convicted of offenses against children and controls showed important differences among most tests of the WIP and global intelligence, and the greatest difference

was found in the mosaic test, which is the test that mostly proves the existence of neurodevelopmental conditions (Kruger & Schiffer, 2011). The results did not depend on the age variable or educational level because these factors were controlled. The d2 Attention-Deficit Test showed that convicted people with pedophilia had a slightly weaker performance. If the age variable was controlled as a confounding factor, the only differences concerned information velocity, capacity, and vigilance, but not the total score and the fluctuation margin. Visuospatial memory capacity was within the normal range, and significant differences were observed between convicted PWP and controls for nonperseverative errors and total errors in the WSCT-64 (Kongs et al., 2000). No differences were identified in perseverative errors and responses, and these results indicate that convicted PWP do not have any deficits with the normal executive control, located in the dorsolateral prefrontal cortex (DLPFC) (Kruger & Schiffer, 2011). The findings contrast with previous results concerning convicted PWP, which had highlighted weaknesses in functions associated with the DLPFC, such as decision-making ability and inhibition skills. This could be explained by the inability of the WCST-64 to detect these differences (Kruger & Schiffer, 2011).

In general, results showed that pedophilia was not associated with any specific pattern of executive dysfunctions and that impairments are just discretely weaker. The authors wondered whether such deficits depend on the sample or can be partly explained by a neurodevelopmental disorder, and suggested continuing the research using more homogeneous samples (Kruger & Schiffer, 2011).

Eastvold et al. (2011) analyzed seven different executive functioning domains between pedophilic (PED, n=30), non-pedophilic (NPED, n=30) people convicted of sexual offenses against children, and people who committed nonsexual offenses (NSOs) (n=29). Participants were classified as pedophilic if they stated a greater interest in prepubescent children or if phallometric testing showed greater sexual arousal toward this category (Eastvold et al.,

2011). Handedness was assessed through the Chapman Handedness questionnaire and interviews were conducted to gather information on demographics and head injuries. The measured executive functions comprised switching, inhibition, working memory, abstraction, simple attention, planning, fluency, and semantic knowledge (Eastvold et al., 2011). Each one of them was measured using subtests from the Delis Kaplan Executive Function Scale (DKEFS) (Delis et al., 2001) and the subtests were also treated as a unitary construct (Eastvold et al., 2011). The results revealed significant differences between groups in distinct subscales. Both PEDs and NPEDs performed worse on inhibition compared to NSOs, but significantly better on abstraction. Specifically, concerning inhibition skills, PEDs had the weakest performance, but the group's weakness was related to speed rather than accuracy. Meanwhile, NPEDs were not only slow but also made more errors than PEDs. One explanation is that pedophilic convicted people probably had to develop greater self-monitoring which led them to perform slower but more accurately, thus their priority is accuracy rather than speed. This explanation reflects the groups' *modus operandi*: child sexual abuses committed by PWP are more planned and accurate, as they prefer to groom their victims; on the other hand, non-pedophilic people who offend against children tend to act more impulsively and rely on circumstances. This theory is also supported by the fact that PEDs showed a stronger performance on planning ability compared to NPEDs. What the authors conclude is that each group showed distinct patterns of strengths and weaknesses (Eastvold et al., 2011).

The IQ given by the unitary construct and the semantic knowledge showed no significant differences between groups, but PEDs performed slightly better than NPEDs, and both groups scored higher than NSOs. These results seem to contradict previous findings which correlated a low IQ with younger victims (i.e.; Cantor et al., 2004; Cantor, Robichaud, et al., 2005), but this difference can probably be explained by the prior inclusion of people with mental

retardation, and the heterogeneity of the other samples (i.e., Blanchard et al., 1999; Cantor et al., 2004) (Eastvold et al., 2011). PEDs committed the lowest mean number of errors, while NPEDs executed the highest one (Eastvold et al., 2011).

Previous studies had gathered evidence in support of the neurodevelopmental hypothesis (Blanchard et al., 2003; James M. Cantor et al., 2004; James M. Cantor, Klassen, et al., 2005), however, this research did not (Eastvold et al., 2011). This study gives us important information on the kind of intervention programs that PEDs and NPEDs could benefit from: for example, NPEDs could benefit from programs that help them control their impulsivity, while PEDs could benefit from understanding and accepting their atypical sexual preference. The research presents some limitations: the sample was too small to conduct any sophisticated statistical comparisons, and the groups were not completely matched (Eastvold et al., 2011).

Schiffer & Vonlaufen (2011) as well sought to understand whether pedophilic and non-pedophilic CSOs have different patterns of executive functioning. The sample was made of 15 PWP who abused children (P+CSOs), 15 people without pedophilia who abused children (CSOs-P), and 33 controls (16 people convicted of nonsexual offenses and 17 healthy controls) with matched educational level and age (Schiffer & Vonlaufen, 2011). The first group met the DSM-IV criteria for pedophilic disorder. The neuropsychological assessment included the WCST, the TMTV (Broshek & Barth, 2000), the “Regensburger Wortflüssigkeitstest” (Aschenbrenner et al., 2000) for verbal fluency, the Corsi Block Tapping (CBT), and the Weschler Memory Scale-Revised (WMS-R) (Weschler, 1986) for visuospatial memory capacity, a go/no-go task (Zimmermann & Fimm, 2002), and the Tower of London (Schiffer & Vonlaufen, 2011).

The IQ scores of the groups were matched, thus it was not considered a confounding variable. Concerning the WCST, P+CSOs showed weaknesses in perseverative errors, while CSOs-P had deficits in all measures of the WCST but did not survive Bonferroni correction.

Both CSOs-P and P+CSOs had a fluency deficit, however, it did not survive Bonferroni correction. The verbal memory task is made of two measures – immediate and delayed recall – and the authors observed a weaker performance in both measures by people convicted of nonsexual offenses and CSOs-P. Previous studies had correlated deficits in verbal memory with aggressive behavior (Wood & Lioffi D Psych, 2006), thus it is understandable that P+CSOs showed no deficit in this area. Regarding the go/no-go task, initially, both P+CSOs and CSOs-P committed more errors during the go/no-go task compared to controls but had the same reaction times. However, the only significant finding was the dysfunction in response inhibition between CSO-P, HC, and people convicted of nonsexual offenses, with CSOs-P performing worse than the others. This finding probably reflects the nature of the crimes perpetrated by non-pedophilic people who abused children and people convicted of nonsexual offenses, which are respectively more impulsive and instrumental. However, in go/no-go tasks there is a difference between commission and omission errors, which Schiffer & Vonlaufen (2011) did not highlight in this study. The first types of error indicate a problem with impulsivity, and the second one with attention, therefore, it is not possible to assess whether data denoted a deficit in attention or impulsivity (Habermeyer & Händel, 2013).

Planning skills, assessed by the Tower of London, reflect impulsivity, and contrary to the authors' hypothesis, CSOs-P performed non-impulsively (Schiffer & Vonlaufen, 2011).

Non-pedophilic CSOs had the worst neurocognitive performance overall even though differences were not statistically significant. The sample was small and researchers investigated multiple hypotheses, which might have made it more difficult to detect group differences (Schiffer & Vonlaufen, 2011).

Franke et al. (2019) carried out a pilot study to identify specific patterns of neuropsychological functions of 15 PWP convicted of sexual offenses against children and 15 people living in a mental disorder facility. The first group met the ICD-10 (WHO, 1993)

criteria for pedophilic disorder. The sample's IQ matched. The subtests go/no-go, Alertness, the Divided Attention from the Test of Attentional Performance (TAP, Zimmerman & Fimm, 2009), and the German version of the Tower of London (Tucha & Lange, 2004) used to assess inhibition, attention, problem-solving skills and planning ability (Franke et al., 2019). The subtests Alertness and Divided Attention assessed respectively "the short-term focus of attention of an expected event" (Franke et al., 2019, p.138) and the ability of the subject to keep track of several events at the same moment.

Even though both groups scored lower on all tests compared to the standard population, statistical analyses showed no significant differences between the groups. People diagnosed with pedophilia who committed offenses against children had a higher rate of errors in the go/no-go task, despite showing a processing speed within the normal range. This highlights a weaker inhibition ability, in line with previous findings (Eastvold et al., 2011; Massau et al., 2017; Schiffer and Vonlaufen, 2011). The fact that the two groups did not differ is in contrast with the authors' hypothesis, but the findings must be interpreted with caution since the study presents several limitations. The study was on convicted people, the sample size was small, and the control group was made of participants who had an organic brain syndrome: such conditions may have occluded the potential effects of pedophilia (Franke et al., 2019).

3.1.2. Offending PWP: Limitations and Conclusions

There are specific limitations common to the cited studies. The authors often referred to the participants as child offenders with pedophilia (i.e., Eastvold et al., 2011; Schiffer & Vonlaufen, 2011). Nonetheless, participants were identified as pedophilic based on their victims' history and their sexual arousal response during phallometric testing (i.e., Suchy et al., 2009). PPG might have helped the identification of the preferred age and gender; however, it is known that people convicted of offenses against children are not necessarily and exclusively attracted to children. Moreover, choosing to study people who have been

convicted can lead to a bias since weaker cognitive functions can increase the likelihood of getting caught (Franke et al., 2019). Massau et al. (2017) tried to resolve this bias by comparing offending and non-offending PWP.

The first researchers that focused on the association between pedophilia and a low IQ exhibited evidence of this correlation (Blanchard et al., 1999; Cantor et al., 2004; Cantor, Robichaud, et al., 2005; Kruger & Schiffer, 2011). Nonetheless, some problems related to the samples could have influenced the results: samples were very heterogeneous, they included people with mental retardation, and couldn't distinguish whether this weakness was specifically associated with pedophilia or general criminogenic tendencies. Eastvold et al., (2011), who compared PWP convicted of offenses against children, convicted people without pedophilia, and people who committed nonsexual offenses, observed that the first two groups showed higher IQ scores compared to the last one, therefore that a weaker global intelligence might be affected by other factors than pedophilia per se. Moreover, I believe that it would be more relevant to research, prevention, and intervention programs to investigate the possible distinct neuropsychological profiles related to PWP, considering global intelligence and educational level confounding variables. Studies showing low IQ scores support the neurodevelopmental hypothesis, but the correlational nature of research doesn't allow the authors to draw any definitive and causal conclusions. On the other hand, understanding the pattern of the executive (dys)functions that PWP show allows researchers to develop programs that focus on strengthening their weaknesses. This is exactly what more recent scholars have done when approaching this field: they have outlined specific executive dysfunctions concerning pedophilia. Researchers have found a correlation between weaker executive functions, greater penile response, and the number of offenses against children under 12 years old. Specific weaknesses observed in people with pedophilia who abused children were found in response inhibition, abstract reasoning, cognitive flexibility,

processing speed, and attention (Cantor et al., 2004; Eastvold et al., 2011; Kruger & Schiffer, 2011; Suchy et al., 2009; Tost et al., 2004). Pedophilic men don't show a clear deficit in response inhibition, instead, they seem to have distinct profiles of reaction times and erroneous responses, probably related to their response style, usually non-aggressive and planning oriented (Eastvold et al., 2011; Habermeyer et al., 2013). Supporting this hypothesis, they also performed better than non-pedophilic convicted people in tests that assessed planning skills and impulsivity (Eastvold et al., 2011; Schiffer & Vonlaufen, 2011).

Deficits concerning semantic knowledge, speed and accuracy in response inhibition, and verbal memory task (immediate and delayed recall) were detected in non-pedophilic convicted people (Eastvold et al., 2011; Schiffer & Vonlaufen, 2011; Suchy et al., 2009). What these last studies have in common is the sample, which included also pedophilic convicted people, healthy controls, and/or people convicted of nonsexual offenses. Within these studies, most of the time both groups of child abusers performed worse when compared to controls and/or people convicted of nonsexual offenses; but when comparing the two of them, non-pedophilic incarcerated people had a worse neurocognitive performance. It is not known why non-pedophilic men showed weaker executive functions compared to offending PWP, but such findings point to the hypothesis that executive deficits are linked to other factors rather than to pedophilia.

Table 2*Summary of the findings on executive functions and convicted people with pedophilia*

Authors	Sample	Findings	Specific limitations
Blanchard et al. (1999)	678 offending PWP (divided into homosexual, bisexual, heterosexual) 313 gynephilic people	<ul style="list-style-type: none"> • Gynephilic and pedophilic heterosexual offenders more intelligent than bisexual and homosexual offenders • Lower IQ scores linked to greater interest in younger, male children 	<ul style="list-style-type: none"> • Data collected for a different purpose • No standardized IQ scores • Self-reports • PPG
Tost et al. (2004)	4 offending PWP	<ul style="list-style-type: none"> • Weakness in abilities related to the frontal areas of the brain (response inhibition, WM, abstract reasoning, cognitive flexibility) 	<ul style="list-style-type: none"> • Small sample
Cantor et al. (2004)	48 offending PWP 95 teleiophilic 161 hebephilic	<ul style="list-style-type: none"> • Pedophilic offenders: lowest IQ scores • Weaker executive functions related to greater phallometric response to children-related stimuli and number of offenses against children 	<ul style="list-style-type: none"> • Categorical approach • PPG
Cantor, Robichaud et al. (2005)	Quantitative re-analysis	<ul style="list-style-type: none"> • Pedophilic and non-pedophilic offenders: lowest IQ scores compared to controls • Pedophilic offenders: lowest IQ compared to non-pedo • The younger the victims, the lower the IQs 	
Blanchard et al. (2007)	106 offending PWP 340 hebephilic 386 teleiophilic	<ul style="list-style-type: none"> • Correlation between low IQ and pedophilia 	
Suchy et al. (2009)	20 offending PWP 20 non-pedophilic child offenders 20 male controls	<ul style="list-style-type: none"> • Both groups of offenders: weaker executive functions and higher rates of LD compared to controls • Pedophilic offenders: deficit in PS • Non-pedophilic offenders: deficit in SK 	<ul style="list-style-type: none"> • Not standardized scores of PS and MS • Small sample • Sample made of convicted people • Self-reports
Kruger & Schiffer (2011)	30 offending PWP 24 healthy controls	<ul style="list-style-type: none"> • Pedophilic offenders: lower IQ and weaker performance most tests of the WIP • No executive dysfunctions pedophilia-specific 	

Eastvold et al. (2011)	30 offending PWP 30 non-pedophilic child offenders 24 non-sexual offenders	<ul style="list-style-type: none"> • Pedophilic offenders: deficit in response inhibition (speed), stronger planning ability, SK and lowest mean number of errors compared to non-pedophilic • Non-pedophilic offenders: deficit in speed and accuracy in response inhibition compared to pedophilic • Both child offenders: worse performance in response inhibition, better one in abstraction and IQ scores when compared to controls 	<ul style="list-style-type: none"> • Small sample • No sophisticated statistical comparisons • Group were not completely matched • PPG
Schiffer & Vonlaufen (2011)	15 offending PWP 15 non-pedophilic child offenders 33 healthy controls and non-sexual offenders	<ul style="list-style-type: none"> • Non pedophilic offenders: worst cognitive performance overall, deficit in response inhibition and cognitive flexibility compared to controls, weakness in verbal memory task compared to pedophilic 	<ul style="list-style-type: none"> • Small sample • Multiple hypotheses • No distinction between omission and commission errors: is it an attentional or an impulsivity problem?
Franke et al. (2019)	15 offending PWP 15 people living in a mental facility	<ul style="list-style-type: none"> • Both groups: lower scores in all tests compared to standard population • Pedophilic offenders: higher rate of errors, normal speed 	<ul style="list-style-type: none"> • Small sample • Participants had brain syndromes

3.3. Comparing Offending and Nonoffending People With Pedophilia

To my knowledge, the only study comparing P-CSOs and P+CSOs' executive functions was conducted by Massau et al. (2017). To aim of their study was to distinguish executive (dys)functions associated with pedophilia and those associated with the offense status. They hypothesized that non-pedophilic people convicted of offenses against children would perform worse than the other groups in WM, cognitive flexibility, and impulsivity.

Massau et al. (2017) chose a sample made of 45 offending PWP (P+CSOs), 45 non-offending PWP (P-CSOs), 19 men who abused children without pedophilia (CSO-P), and 49 HCs. Participants were matched for IQ, handedness, sexual orientation, and age (Massau et al., 2017). Global intelligence was assessed by using four subtests from the German version of the WAIS (Molz et al., 2010) and five subtests from the CANTAB (Cambridge Cognition Ltd, 2011) were used to measure set-shifting, working memory, planning abilities, response

inhibition, and impulsivity (Massau et al., 2017). The groups of CSOs, independently of their preferred erotic gender and age, showed longer time reactions in the SSRT, indicating a general problem in response inhibition. This suggests that pedophilia per se is not linked to deficits in this task and that CSOs in general have a problem controlling their impulses. CSOs-P had worse strategic working memory usage compared to all other groups, while P+CSOs showed better set-shifting ability compared to HC and P-CSO. It implies that the set-shift ability is influenced by both the erotic preference and the offense status, which is not in line with previous studies (Kruger & Schiffer, 2011; Schiffer & Vonlaufen, 2011). Nevertheless, none of these findings survived Bonferroni corrections. This research does not show any specific neuropsychological profile related to pedophilia; however, it also investigated the effect that age has on pedophilic participants, indicating that neurocognitive dysfunctions in PWP increase with age. The study presents several limitations. People with pedophilia showed limited cognitive deficits, one possible interpretation could be that the cognitive abilities of those who have not been incarcerated are more preserved when compared to other groups who have been convicted (Massau et al., 2017). Educational level and psychiatric comorbidities could represent confounding variables, and PPG was not used to further assess the individual's erotic preference, as self-reported information was considered sufficient (Massau et al., 2017).

3.4. Offending and Non-offending People With Pedophilia: Conclusions

The authors conclude that their research demonstrated that people who engage in sexual offenses against children struggle to control their impulses, that non-pedophilic men who abused show a weakness in WM, and pedophilic men have better set-shifting abilities and planning skills. Massau et al., (2017) sustain that further research in this field is needed and that if their findings are replicated, this piece of information could be integrated when planning interventions. Cognitive-behavioral therapy (CBT) could focus on improving those

disabled executive functions to prevent recidivism. Some more studies used neuroimaging techniques to compare PWP, P-CSOs, P+CSOs, and CSO-P and identify differences in cognitive and affective processes. These studies attained interesting results and they will be analyzed in the next chapter, hoping they will outline more conclusive findings.

CHAPTER 4

Brain Alterations in Pedophilia

As already explained in chapter 1, the etiology of the disorder is relatively unknown, but pedophilia appears to be associated with structural and functional brain anomalies. Many neuroimaging studies have been carried out to understand whether any specific areas of the brain revealed abnormalities and what their correlations to functional deficits are. The main neuroanatomic theories concerning pedophilia belong to two main categories: *Frontal-Dysexecutive Theories* and *Temporal-Limbic Theories*. The first group sustains that pedophilic behavior is caused by dysfunctions of frontal areas that lead to disinhibited actions; the second is that temporal and limbic dysfunctions affect sexual maturation and lead to atypical sexual urges (Cantor et al., 2008). Scholars have decided to focus their research on either one category or the other, although someone also supports *Dual Dysfunction Theories*, that state the presence of a dual deficit in the previously mentioned brain areas (Cantor et al., 2008).

The most interesting research used Magnetic Resonance Imaging, Diffusion Tension Imaging, and Functional Magnetic Resonance Imaging.

4.1. Magnetic Resonance Imaging (MRI) Studies

Magnetic Resonance Imaging (MRI) is a structural neuroimaging technique utilized to acquire anatomical imaging of the body (Reimer et al., 2016), in this case of the brain. This technique produces either two or three-dimensional high-quality images (Forshult, 2007). Along with MRI, most researchers use voxel-based morphometry (VBM) to assess the amount of local gray matter in the region of interests (ROIs) (Cantor et al., 2008; Lett et al., 2018; Schiffer et al., 2017; Schiffer et al., 2007; Schiltz et al., 2007). VBM is a neuroimaging method that assesses the distribution of different brain tissues, such as white matter (WM),

gray matter (GM), and cerebrospinal fluid (CSF) (Ocklenburg & Gunturkun, 2017). White matter is made of myelinated axons and neurons which form the neural networks of the brain involved in connectivity (Filley & Fields, 2016). White matter lesions can lead to disruptions in functional connectivity (FC) (Langen et al., 2017). Gray matter is a brain tissue that forms most of the external part of the brain (Mercadante & Tadi, 2022).

Structural neuroimaging studies on pedophilia have shown a reduction in the volume of specific brain areas (i.e., Mohnke et al., 2014).

Results from the first MRI study on offending PWP were promising but inconclusive (Eher et al., 2000), as the location of these alleged structural abnormalities was unclear, and a control group was missing (Mohnke et al., 2014).

The first conclusive data was drawn by Schiltz et al. (2007), who analyzed the MR imaging of 15 CC and 15 PWP who engaged in offenses against children and met the DSM-IV criteria for pedophilic disorder. VBM was performed by comparing gray matter segments of the predefined region of interests (ROIs). The four ROIs were: (1) the left and (2) right amygdala, (3) bilateral structures (bed nucleus striae terminalis (BNST) and septal region), and (4) bilateral structures (substantia innominata and hypothalamus) (Schiltz et al., 2007). Brain tissue reduction was assessed through qualitative grading of CFS enlargement in distinct brain areas, and it revealed an enlargement of the right temporal horn of the lateral ventricles that borders the amygdala in pedophilic men. The volume of the temporal horn was also measured by using VBM, and the results supported the findings concerning the right temporal horn. Statistical analysis also showed a great reduction of the volume of the amygdala in pedophilic men, only for the right side. Moreover, the VBM assessed a GM deficiency in the right side of the amygdala. In addition, volume reduction of the right amygdala correlated with the enlargement of the anterior temporal horn. The temporal horn is a cavity filled with CFS, and it is part of the hippocampus (Zhou et al., 2022). The right

amygdala is strictly related to the development of sexual behavior (Schiltz et al., 2007). In addition, GM reductions were also present in the BNST, the septal region, and hypothalamic areas, and extended to some parts of the substantia innominata (Schiltz et al., 2007). These internal areas of the brain are connected to the amygdala and interfere with the development of appropriate sexual maturation. The authors tried to establish an association between amygdalar reduction and the type of offense committed by participants and concluded that a smaller volume of the right amygdala was correlated with continuous pedophilic offenses, especially with incestuous activity. Such reduction in volume did not depend on the age variable and neither progressed with age, which suggests that a neurodevelopmental deficit may be involved in pedophilia. However, it is not possible to infer its etiology and direct pathogenic action on the development of the disorder (Schiltz et al., 2007).

The following study was published by Shiffer et al. (2007). Researchers compared 18 people who offended and met the DSM-IV criteria for pedophilia and 24 healthy controls. First, the authors conducted a neuropsychological and personality assessment of both groups. The instruments used were the WIP, the WCST, the Corsi Block-Tapping test, the d2 Attention-Deficit Test, the Multiphasic Personality Inventory-Version 2 (MMPI-2) (Hathaway et al., 2001), and the Multiphasic Sexuality Inventory (MSI) (Deegener, 1995). To measure structural brain differences they used MRI and an optimized version of VBM (Schiffer et al., 2007). The authors observed a GM reduction in the bilateral insula, the bilateral ventral striatum (putamen), the bilateral orbitofrontal cortex (OFC), and the cingulate and parahippocampal gyri in PWP. Some alterations were present as well in the posterior cerebellum and the anterior vermis, but no differences were found concerning white matter and CSF volume. The OFC and the putamen may be part of the brain network expressing the pathophysiology of pedophilia, albeit not being pedophilia-specific since these areas are involved in other deviant behaviors. The results showed a significant negative correlation

between frontostriatal abnormalities and depressive/obsessive symptoms (Schiffer et al., 2007). These regions are also part of the serotonergic and dopaminergic pathways and play a key role in the reward system. A deficit in the reward system may lead to addictive, compulsive, or impulsive behaviors, consequently playing a role in the expression of pedophilia. Neuropsychological tests also demonstrated that pedophilic men struggle more with rule-adopting behavior, cognitive flexibility, and impulse control. These functions are executed by areas located in the anterior cingulate gyrus and the dorsolateral prefrontal cortex (DLPFC), thus abnormalities in the OFC may explain impulsive behavioral responses.

A difference in the amygdala was not found, however, in a post hoc analysis that stayed unpublished, Schiffer (personal communication) confirmed a reduction of the volume of the right amygdala, in line with prior findings (Schiltz et al., 2007) (Mohnke et al., 2014). Such results may lead to the conclusion that pedophilia is associated with neurodevelopmental deficits (Schiffer et al., 2007). However, one of the limitations of this study is the un-specificity of the findings, since these impairments cannot be strictly linked to pedophilia because they are common also to other atypical behaviors (Schiffer et al., 2007).

Contrary to other authors, Cantor et al. (2008) compared 44 people convicted of offenses against children (hebephilic and pedophilic) and 53 people who committed non-sexual offenses. Participants were identified as pedophilic if they stated their interest in prepubescent children if there was greater arousal during phallometric testing with children-related stimuli, or if they had a history of sexual offenses against children of 14 years old or younger (Cantor et al., 2008). MR images were acquired and VBM analyses were conducted, along with neuropsychological and handedness assessment. The authors wanted to detect any changes in four sets of tissue: cortical gray matter, subcortical gray matter, white matter, and CSF. Results showed a significant reduction of white matter in the temporal lobe, parietal lobe, and corpus callosum among pedophilic men. Voxels comparison also detected white matter

reduction, specifically in the right arcuate fasciculus and the superior frontal-occipital fasciculus, but no differences were found concerning GM. The significant low volume of white matter suggested the presence of neurocognitive deficits in addition to atypical sexual preference. Indeed, pedophilic participants showed lower IQs compared to controls, weaker visuospatial and verbal memory abilities, a greater prevalence of left-handedness, and a higher rate of head injuries (Cantor et al., 2008). These results contrast with the findings of Schiltz et al., (2007) who highlighted an association between GM volume reduction and pedophilia. Such differences could be explained by the size of the two samples, which in this case was bigger, and therefore had more statistical power (Cantor et al., 2008). Moreover, researchers compared two different groups: Schiltz et al. (2007) compared offending PWP with healthy controls, while Cantor et al. (2008) chose people convicted of nonsexual offenses as their control group (Cantor et al., 2008). This means that the findings obtained by Schiltz et al. (2007) could be associated with factors like criminogenic tendencies or chronic stress rather than pedophilia (Cantor et al., 2008). As usual, the link between pedophilia and low white matter volume is not clear: pedophilia per se could be the cause of this morphological anomaly, a third variable could be involved in the development of both conditions, or white matter reduction could cause pedophilia (Cantor et al., 2008). The findings made the authors suggest that the development of pedophilia may be influenced by dysfunctional connectivity, like many other mental disorders (schizophrenia, bipolar disorder...). Thus, future connectivity research could shed light on this theory (Cantor et al., 2008).

Despite neurobiological research highlighting a connection between pedophilia and structural brain anomalies, the specificity of the findings seems to be mostly influenced by criminality rather than the disorder. Poepl et al. (2013) tried to overcome this problem by doing the same thing as Cantor et al. (2008) did, which was taking two different groups of

convicted people: 9 people with pedophilic tendencies who committed abuses against children and 11 people who committed non-sexual offenses.

Even though Cantor et al. (2008) observed differences in WM, Poepl et al. (2013) hypothesized GM differences in the frontostriatal and limbo-diencephalic areas. In addition, they wanted to verify whether structural anomalies correlated with phenotypic characteristics in pedophilic men.

MR imaging and VBM analyses were conducted to identify morphological differences between groups; their IQ, handedness, and sexual orientation were also assessed. The results showed evidence of GM reduction in the right amygdala. The amygdalar reduction was not influenced by the age variable and did progress with age, therefore it seems to be a pre-existing condition useful to distinguish pedophilic from non-pedophilic men, in line with Schiltz's (personal communication) and Schiffer et al., (2007) findings (Poepl et al., 2013). Thus, it seems to be the only characteristic specifically related to pedophilia as a common feature, and this condition could increase the risk of developing pedophilia (Poepl et al., 2013). However, within the pedophilic group, GM reduction was influenced by the victim's age. GM reduction in the OFC and bilateral angular gyri was associated with the lower age of victims. Changes in the left DLPFC and the left insular cortex were linked with a sexual interest in older children. The DLPFC executes high functions, and the insula is a key area involved in emotions, self-awareness, and sexual arousal mediation. The results could explain why previous research led to different findings since distinct morphological differences could reflect different features of pedophilia. The findings are statistically significant but the sample is small, therefore researchers should attempt replicating them (Poepl et al., 2013).

To my knowledge, Schiffer et al. (2017) were the first ones to investigate structural brain differences between P+CSOs and P-CSOs. The sample was made of 60 P-CSOs, 58 P+CSOs, and 101 non-offending teleiophilic men (control group) (Schiffer et al., 2017). Pedophilia was

diagnosed according to the ICD-10 (WHO, 1993), moreover, global intelligence, impulsivity, and empathic abilities were assessed, along with the presence of any other mental disorders. (Schiffer et al., 2017). MR imaging and VBM were used to verify the presence of morphological distinctions (Schiffer et al., 2017). The risk of re-offending was measured with the SSPI-2. No differences were observed between non-offending PWP and controls, but results indicated a significant GM alteration between offending and non-offending PWP, with a reduction of GM of the right temporal pole (TP) among P+CSOs. These findings were not influenced by any confounding variables, and this suggests that GM is involved in the risk of offending. The research proved a negative correlation between the volume of GM in the dorsomedial PFC/ACC and the risk of re-offending, assessed with the SSPI-2. These areas are indeed involved in conflict monitoring and behavioral control, therefore results are in line with previous findings which suggested CSOs were characterized by a deficit in response inhibition (i.e., Massau et al., 2017) (Schiffer et al., 2017). No alterations were found concerning the amygdala, but *post hoc* analysis indicated that the lack of evidence might have been influenced by an imbalance in participants' sexual orientation. The study presents some limitations because it does not explain causal relationships, and P-CSOs could have lied about their lack of offense history (Schiffer et al., 2017).

Lett et al. (2018) investigated the differences in cortical thickness (CT), surface area (SA), and white matter fractional anisotropy (FA) between P-CSOs, P+CSOs, and HCs with MR imaging. The total sample was made of 73 P+CSOs, 77 P-CSOs, and 113 non-pedophilic controls (NPC, teleiophilic men) (Lett et al., 2018). Pedophilic men met the ICD-10 diagnosis for pedophilic disorder. The group of PWP was recruited from the Prevention Project Dunkelfeld (Lett et al., 2018). Global intelligence was assessed using the WAIS-II (Wechsler, 1999, 2014), which gives a Full-Scale Intelligent Quotient (FSIQ), and exclusion criteria included experiencing psychotic, depressive, and anxiety symptoms, having substance use

disorder, mental disability, somatic or neurological illness, or being on psychotropic medications. The authors first verified the association between FSIQ and the offense status, observing that lower FSIQ was indeed correlated to the offense and that offending PWP scored lower compared to controls. No differences were found between non-offending PWP and controls. Lower CT was observed in the right motor and premotor cortices compared to both P-CSOs and controls, in the left temporal lobe in comparison to P-CSOs, and additionally in the right precuneus compared to controls. No CT alterations were identified between P-CSOs and controls. There was also a reduction of cortical SA in the insular regions, orbital frontal, dorsolateral prefrontal, occipital, cingulate, and temporal cortices in P+CSOs in comparison to P-CSOs, and some alterations were also present when comparing them to controls. P-CSOs and controls did not significantly differ. P+CSOs had reductions in white matter FA in the corpus callosum, compared to P-CSOs. These reductions could lead to a lower FSIQ, which indeed P+CSOs showed. These areas are involved in decision making, risk assessment, and inhibitory control, which P+CSOs seem to lack (i.e., Eastvold et al., 2011). What authors concluded is that P+CSOs were characterized by significant reductions in white matter FA, CT, and SA as opposed to both P-CSOs and NPC, therefore, structural brain anomalies could be related to the offense status rather than to pedophilia per se (Lett et al., 2018). However, Lett et al. (2018) did not compare P+CSOs with CSOs-P, hence it is not possible to infer whether such morphological differences are specific to P+CSOs or CSOs in general. Nevertheless, it seems that being attracted to prepubescent children is not a sufficient condition to sexually abuse a child (Lett et al., 2018). Another limitation of the study is the age difference between groups, as P+CSOs were older. Moreover, despite being the largest sample so far related to this topic, the sample is still considered small, and replication is needed (Lett et al., 2018).

Following the structure of Mohnke et al.'s table, I report in Table 3 the results of the studies listed above (Mohnke et al., 2014).

Table 3*Summary of MRI studies*

Authors	Sample	Findings concerning P+CSO
Schiltz et al. (2007)	15 offending PWP 15 community controls	<ul style="list-style-type: none"> ▪ Reduction right amygdala ▪ GM reduction BNST, hypothalamus, substantia innominata, and septal region ▪ Enlargement right temporal horn
Schiffer et al. (2007)	18 offending PWP 24 community controls	<ul style="list-style-type: none"> ▪ GM reduction insula, ventral striatum, putamen, OFC, cingulate and parahippocampal gyri, posterior cerebellum, and anterior vermis
Schiffer (personal communication)		<ul style="list-style-type: none"> ▪ GM reduction right amygdala
Cantor et al. (2008)	44 CSOs (pedophilic and hebephilic) 53 nonsexual offenders	<ul style="list-style-type: none"> ▪ WM reduction temporal lobe, parietal lobe, corpus callosum, the right arcuate fasciculus, and the superior frontal-occipital fasciculus
Poepl et al. (2013)	9 offending PWP 11 nonsexual offenders	<ul style="list-style-type: none"> ▪ GM reduction right amygdala ▪ GM reduction insula and right DLPFC: older age victims ▪ GM reduction OFC and angular gyri: younger victims
Schiffer et al. (2017)	58 offending PWP 60 non-offending PWP 101 teleiophilic controls	<ul style="list-style-type: none"> ▪ Gray matter reduction of the right temporal pole
Lett et al. (2018)	73 offending PWP 77 non-offending PWP 113 teleiophilic controls	<ul style="list-style-type: none"> ▪ Lower CT right motor cortex, premotor cortex, right precunes compared to controls ▪ Lower CT right motor cortex, premotor cortex and left temporal lobe compared to P-CSOs ▪ SA reduction insula, OFC, DLPFC, occipital, cingulate, and temporal cortices ▪ White matter FA reduction corpus callosum

4.1.1. How are These Findings Related to Pedophilia?

I find it fundamental to understand what role these morphological differences have within the development of pedophilia. Common findings were: reduction of GM in the right amygdala (Poepl et al., 2013; Schiltz et al., 2007; Schiffer (personal communication)); GM

and SA reduction in the insular region and OFC (Lett et al., 2018; Poeppel et al., 2013; Schiffer et al., 2007); DLPFC reduction in GM and SA (Lett et al., 2018; Poeppel et al., 2013; Schiffer et al., 2017); reduction of the temporal lobe (and temporal pole) (Cantor et al., 2008; Lett et al., 2018; Schiffer et al., 2017). The findings concerning the amygdala do not seem to be influenced by criminality in general but be specifically related to pedophilia. The right amygdala is associated with sexual maturation and erotic interest in adults (Poeppel et al., 2013; Schiltz et al., 2007). Moreover, the BNST, the hypothalamus, the substantia innominata, and the septal region (Schiltz et al., 2007) are connected to the right amygdala and are part of the neural networks affecting sexual maturation, therefore, it sounds reasonable for a deficit in these areas to lead to a failure in the development of appropriate sexual behavior and interest (Schiltz et al., 2007).

Schiffer et al. (2007) found a volume deficiency in the OFC, the ventral striatum, including the nucleus accumbens and the putamen, the PFC, the cerebellum, the hippocampus, and the cerebral vermis (Schiffer et al., 2007). The striatum, prefrontal cortex, and hippocampus are all part of the reward system (Baik, 2020), and hedonic hotspots (brain structures that modulate the “liking” response) were found in the nucleus accumbens and the OFC (Mitchell et al., 2018). The reward system is a neural circuit that can modulate impulsive, compulsive, and addictive behaviors (Schiffer et al., 2007). Dysregulations in the reward system are common to several disorders characterized by deviant behaviors, thus a volume deficiency in these areas might explain the expression of pedophilic behavior. The system uses dopaminergic neurons to communicate between areas, therefore, the dopaminergic system might also play a role in pedophilic disorder. In addition, the neurotransmitter serotonin seems to be involved as well, because the serotonergic system projects neurons in some of the areas in which the authors found morphological differences; nevertheless, further studies are needed to understand its implications (Schiffer et al., 2007).

The cerebellum controls fine motor, arousal, autonomic behavior, and emotional reactions (Schiffer et al., 2007). The anterior vermis is part of the cerebellum and is considered its “limbic” part, connected to the ventral tegmental area whose major projections are the PFC and the nucleus accumbens (Schiffer et al., 2007).

Cantor et al. (2008) found white matter reduction in temporal and parietal lobes, the right arcuate fasciculus, and the superior frontal-occipital fasciculus, which suggests a network disconnection. The superior frontal-occipital fasciculus is a bundle that connects the occipital and temporal lobes (Meola et al., 2015), and the right arcuate fasciculus connects the frontal, temporal, and parietal lobes (Nucifora et al., 2005). The lobes are involved in the recognition of sexual stimuli and therefore pedophilia may be partially caused by the disconnection of white matter within this network (Cantor et al., 2008). Indeed, people with right temporal lobe epilepsy have a higher risk of developing sexual dysfunctions (Rathore et al., 2019)

Poeppel et al. (2013) found gray matter reduction in the right amygdala, the insula, right DLPFC, OFC, angular gyrus, and basal and centromedial nuclei. The insula is one of the areas in control of emotions, feeling, sexual arousal, and other functions that the PFC modulates as well (Poeppel et al., 2013). Researchers discovered that the volume of the insula was positively correlated with the degree of interest in prepubescent children and recidivism. On the other hand, the gray matter volume of the DLPFC was negatively associated with pedophilic interest and recidivism (Poeppel et al., 2013). The DLPFC is an important structure implicated in inhibitory mechanisms, cognitive control (Hanlon et al., 2016), and moral reasoning (Zheng et al., 2018). These are the functions in which the insula is involved as well (Poeppel et al., 2013). The most impaired brain regions in PWP were the ones related to social cognition and moral reasoning, like the DLPFC, the amygdala, the OFC, and the angular gyrus (Poeppel et al., 2013). Indeed, the angular gyrus modulates empathy and morality (Poeppel et al., 2013). Moreover, the younger the victims, the greater the structural anomalies,

in line with prior studies (Poeppel et al., 2013). I have already outlined the deficit that CSOs and PWP have concerning response inhibition, and this specific executive dysfunction may be explicated by morphological abnormalities in the OFC, which were more relevant the younger the victims (Poeppel et al., 2013).

Schiffer et al. (2017) identified a negative correlation between the dorsomedial PFC/ACC volume and recidivism and a reduction of gray matter in the temporal pole. The temporal pole is involved in the theory of mind, empathy, and understanding of sexual cues (Olson et al., 2007). As already said, the PFC has a role in decision-making, moral reasoning, and conflict monitoring (Schiffer et al., 2017).

The results are heterogeneous, making it difficult to draw any definitive conclusions. By looking at the samples, the findings most likely linked to pedophilic tendencies concern frontal areas and limbic areas. Just like every other disorder, pedophilia seems to be caused by several differences and dysfunctions that interconnect and make its development easier. Nevertheless, their influence on pedophilic preference is still unclear, since more recent studies have shown evidence that non-offending PWP only slightly from controls, while offending PWP differ from both groups. The only finding that seems pedophilia-specific is the reduction in the right amygdala volume. Findings should be replicated, and new research is needed to better understand the connection between structural anomalies, pedophilia, and offense status.

4.2. Diffusion Tensor Imaging (DTI)

DTI is a neuroimaging technique that measures water diffusion rates to infer microstructural tissue (Vilanova et al., 2006). It is especially useful when studying white matter or muscles, as it can be used to map the tissues and identify alterations (Vilanova et al., 2006). It detects the movements of water molecules in fibrous tissues and quantifies the

fractional anisotropy (FA) (how easy it is for the molecules to move along the tissue) to assess the integrity of the tissue (Vilanova et al., 2006). Cantor et al., (2015) used DTI to support the findings Cantor et al., (2008) obtained concerning white matter reductions. This time the authors compared 32 age-matched healthy controls with 24 offending PWP (Cantor et al., 2015). Pedophilic preferences were assessed through phallometric testing. Participants were administered the Shipley Institute of Living Scale, the Edinburgh Handedness Inventory, the Conflict Tactics Scale (CTS; Straus, 1979), the CAGE (Ewing, 1984), the LPS (Levenson et al., 1995) the Structured Clinical Interview of DSM-IV (SCID; First et al., 1997, 2002), and multiple scales were used to investigate the participants' personal experience of childhood abuse and neglect (Cantor et al., 2015). The trajectories in which FA differed between pedophilic men and controls involved the insula/operculum, temporal pole, superior temporal gyrus, occipital cortex, DLPFC, and superior parietal lobe in the left hemisphere. These structures were less connected. Brain areas more connected in the pedophilic group were the frontal pole and the thalamus. The characteristic of white matter along these regions distinguished offending pedophilic men from healthy controls, as this study proved that future research should expect "an absence of expectable connectivity (perhaps decreasing sexual responses towards adults), but also the presence of unusual connectivity (increasing sexual responses towards children)" (Cantor et al., 2015, p. 2170). The results support Cantor et al. (2008) prior research on white matter dysconnectivity (Cantor et al., 2015).

VBM was performed to identify any GM differences, and when using the same conservative statistical threshold no significant differences emerged, in line with Cantor et al., (2008) results. However, after using a more liberal statistical threshold, Cantor et al., (2015) found GM deficiencies in the same brain structures as other researchers did, such as the insular region (present study plus Lett et al., 2018; Poepl et al., 2013; Schiffer et al., 2017), amygdala (present study plus Poepl et al., 2013; Schiffer (personal communication); Schiltz

et al., 2007), cerebellum (present study plus Schiffer et al., 2007), and superior temporal gyrus (present report plus Schiffer et al., 2007). in the same areas that Schiffer et al., (2007) and Schiltz et al., (2007) found. Thus, it appears that statistical power influences the results of research.

The IQ scores of the group groups were similar, despite the participants having distinct educational levels.

4.3. Functional Magnetic Resonance Imaging (fMRI) Studies

Functional magnetic resonance imaging (fMRI) is a neuroimaging technique that maps the working human brain activity by detecting changes in blood flow and blood oxygenation (Buxton, 2013). Its usefulness lies in its ability to detect patterns of activity between brain areas (Buxton, 2013), thus researchers studying pedophilia decided to use this non-invasive technique to investigate the functional anatomy of PWP.

Sartorius et al., (2008) compared 10 offending people diagnosed with pedophilia (ICD-10; WHO, 1993) with heterosexual controls. All 10 people had abused only boys, and having abused girls was one of the exclusion criteria (Sartorius et al., 2008). Controls were matched for IQ, age, educational level, and handedness (participants were right-handed), and multiple tests were used to exclude psychiatric comorbidity. The researchers used an oddball paradigm to study the activation of brain regions. The odd-ball paradigm is typically used to assess the ability of participants to focus attention and inhibit attention shifts to irrelevant stimuli (Kleih et al., 2011). The authors hypothesized that the presentation of non-explicit sexual stimuli to subjects with pedophilia would increase the activation of areas deputed to processing unconscious emotional stimuli (Sartorius et al., 2008). To analyze unconscious emotional processing, participants were required to focus on non-relevant target stimuli; non-explicit sexual stimuli (i.e., boys in swimsuits) were considered non-targets (Sartorius et al., 2008).

Pictures of boys, girls, men, and women wearing swimsuits were presented. Pedophilic men attracted to boys showed greater amygdalar activation when looking at boys wearing swimsuits. One possible explanation is that pedophilic men feel fearful emotions when looking at stimuli with prepubescent children because they see them as forbidden and illegal. This theory is supported by the lack of amygdalar activation among controls when viewing child-related stimuli, in contrast with a significantly higher activation when exposed to women-related stimuli. However, it could also reflect an appetitive response to stimuli considered sexually salient. Nevertheless, this finding was present regardless of the sexual gender of the presented child, albeit the homosexuality of participants. It led the authors to suggest that PWP lack a mechanism that reduces the emotional salience of unfamiliar children. It is possible to make a correlation between its hyperactivation and the reduction of its volume (i.e., Schiltz et al., 2007), suggesting that either a morphological anomaly increases the activity of the amygdala, or a continuous overactivation leads to volume damage (Sartorius et al., 2008).

Habermeyer & Händel (2013) collected fMRI data on 11 pedophilic males who met the DSM-IV criteria for pedophilic disorder, and either committed sexual offenses against children or used child pornography. They were compared with 8 healthy controls. Subjects were undergoing an fMRI while performing a go/no-go task. The authors wanted to assess the two groups' mean reaction time (RT) and investigate which brain areas were active along the network involved in response inhibition (Habermeyer & Händel, 2013). Prior studies had identified a deficit in response inhibition among pedophilic men (i.e., Eastvold et al., 2011; Schiffer and Vonlaufen, 2011). Habermeyer & Händel (2013) expected pedophilic men to have longer RTs in the go/no-go task. Wager et al. (2005) had previously identified the areas involved in response inhibition, and the network included the anterior insula, the anterior PFC, the DLPFC, the parietal cortices, and the motor area. During the go task, on the other

hand, the left precuneus, the anterior cingulate, and the angular gyrus should be more active. The precuneus modulates episodic memory, self-processing operations, and visuospatial imagery and is connected to the parietal lobe. The precuneus and gyrus angularis is part of the Default Mode Network (DMN). The DMN is implicated in mentalizing and self-reflection, and the brain areas that are part of the network are more active during resting state conditions (Raichle et al., 2001), while their activity decreases during goal-directed tasks (Habermeyer & Händel, 2013). Specifically, the findings revealed that differences between groups in the no-go condition involved the Default Mode Network (DMN). The network was hyperactivated among pedophilic men during the no-go task, despite it being more challenging. Thus, the pedophilic group was more focused on self-reflection and thinking about the mental state of others than directing their attention to the task. In addition, pedophilic men showed less accurate visual discrimination ability between targets and distracters, and RTs were longer during the no-go task, while the number of commission errors was adequate. It points to inattention rather than impulsivity. It means that failing in reducing the activation of the DMN during the no-go task is reflected in a measurable behavioral response, causing inattention and longer RTs (Habermeyer & Händel, 2013). Given the fact that participants were aware that the experimental paradigm addressed the topic of their sexual preference (considered socially unacceptable), it is understandable if they were more focused on self-referential processes, which led to a failure in deactivating the DMN.

Contrary to prior findings (Sartorius et al., 2008), no differences were observed in frontal brain structures, therefore future research is needed (Habermeyer & Händel, 2013). The study presented several limitations: the sample included also people convicted of the use of child pornography, and most of the time they were outpatients instead of inpatients. Research has shown that people who use child pornography have higher educational levels, stronger global intelligence, and higher rates of employment compared to people who abused children. This

could explain why the authors did not find frontal anomalies. Additionally, the sample was small and heterogeneous in terms of age and sexual orientation, and the number of participants belonging to the groups was not balanced. Moreover, go/no-go tasks involve several cognitive processes besides response inhibition that could not be distinguished (Habermeier & Händel, 2013). “Further studies on the interplay between attentional and frontal control networks in relation to the default network might be a promising approach to further our understanding of the neurobiology of pedophilia” (Habermeier & Händel, 2013, p. 236).

Poeppel et al. (2015) decided to investigate the relationship between altered brain structures and functional connectivity (FC) to delineate their functional roles. The altered structures are called seed regions. Seed regions were brain areas previously identified by Poeppel et al. (2013), characterized by GM alterations. The areas were: the right amygdala, left and right temporoparietal junction, left insula, and medial OFC (T. Poeppel et al., 2013). The researchers assessed the FC of the seed regions during task performance (task-dependent FC) and resting-state conditions (task-independent FC). They hypothesized that seed regions were part of networks involved in social and sexual cues processing. To understand this correlation, first, they used the identified brain networks that activate and deactivate during sexual arousal (Poeppel et al., 2014) and analyzed if they overlapped with seed regions. The analysis revealed an intersection cortico-thalamo-limbic network. The authors observed an overlap of the left extrastriate cortex, DLPFC, hippocampus, and superior parietal lobe. These regions process salient sexual stimuli and modulate attention during sexual arousal. The DLPFC and the hippocampus are part of the reward system and categorize visual stimuli. One more overlap was found in the amygdala, thalamus, and midbrain, which are involved in feelings of pleasure, possibly due to dopaminergic pathways that project in these areas. They also play a role in the emotional and motivational components of sexual arousal. Two more overlaps

were found in the anterior insula, which plays a key role in the salient network, and in the left TPJ and right STG, whose activation decreased during sexual arousal.

In conclusion, morphologically altered brain regions were functionally connected to brain areas that modulate sexual processing. Connectivity dysfunctions between these areas may lead to atypical emotional processing (amygdala, thalamus) and miscategorization (hippocampus, DLPFC) (Poepl et al., 2015). In addition, the authors observed that pedophilic men showed a different pattern of activation compared to healthy controls in the DLPFC, amygdala, thalamus, STG, and superior parietal lobe in response to child-related or adult-related sexual stimuli. “The present results indicate functionally dysconnectivity within brain regions that serve to identify sexually relevant stimuli” (Poepl et al., 2015, p. 2383).

Kärgel et al. (2015) decided to use fMRI during the resting state to compare FC between 14 P-CSOs, 12 P+CSOs, and 14 HC. The participants met the criteria of the DSM-IV for a pedophilic diagnosis (Kärgel et al., 2015). Psychiatric comorbidity was an exclusion criterion and the subjects’ global intelligence was assessed using four subtests of the WAIS-IV (Molz et al., 2010) (Kärgel et al., 2015). The authors were most interested in the FC of the posterior cingulate cortex (PCC), a key structure of the DMN, and the amygdala-OFC connectivity, thus ROIs analyses were conducted, and the researchers expected a temporofrontal dysfunction among people with pedophilia. Compared to non-offending men, offending PWP had diminished connectivity to the left OFC and medial superior frontal areas, during resting state functional connectivity (RSFC). Offending PWP demonstrated the lowest PCC-OFC correlation during RSFC. The dorsomedial PFC, involved in the theory of mind, also showed a decrease in FC among offending PWP when compared to non-offending PWP. Seeding from the left amygdala, diminished FC was also present in the OFC, extending to the ACC and the medial PFC. The ACC has a cognitive and affective division, and both of them had diminished FC with the left amygdala among P+CSOs. The left amygdala-inferior temporal

cortex (ITC) connectivity was reduced as well, and it is associated with sexual and motivational characteristics of visual stimuli. This study highlights different FC between P+CSOs and P-CSOs, suggesting that prior findings concerning diminished FC in distinct brain regions might not be pedophilia-specific but related to the offense (Kärgel et al., 2015). Therefore, reduced FC in the amygdala or the PFC could represent a biomarker that increases the likelihood of offending, and in fact, similar results were found among violent offenders (Motzkin et al., 2011). One of the limitations of the study is that the groups were not matched for age, albeit it is unlikely that the age difference could influence the results since the authors did not find any correlations between age and FC at resting state. The sample was made of people attracted to both girls and boys, despite this, the gender variable did not affect the results since it was included in the study as a covariate of no interest. One more limitation is that the P+CSOs group was recruited from correctional facilities, and incarceration status could have influenced the results (Kärgel et al., 2015).

Cantor et al. (2016) used fMRI to study the functional connectivity of 37 offending PWP, 28 non-pedophilic people convicted of abuses against children and 38 healthy controls. Phallometric testing was used to assess pedophilic interests. Psychiatric comorbidity was evaluated through the Structured Clinical Interview, and neuropsychological measures included the SILS (Shipley, 1940), the Edinburgh Handedness Inventory, the CAGE screening instrument for alcohol use, the Levenson Psychopathy Scale (LPS; Levenson et al., 1995), the Conflict Tactics Scale (Straus, 2017), and the Self-Report Childhood abuse (Widom & Morris, 1997; Widom & Shepard, 1996; Widom & Weeks, 1998). fMRI data on resting state conditions were performed, as well as Independent Component Analysis (ICA) to identify FC of brain networks of interest (Cantor et al., 2016). FC between the DMN and several brain areas was greater among offending PWP compared to the other groups combined. Before this research, Stoléru et al. (2012) had identified a sexual response network

(SRN), that is, a network of 26 brain regions involved in the processing of sexual stimuli (Cantor et al., 2016). Cantor et al. (2016) proved that 20 of the brain structures that are part of the SRN showed a different FC pattern among pedophilic men compared to controls, thus the authors concluded that dysconnectivity in the SRN could play a role in the development of pedophilia.

Kärgel et al. (2017) collected fMRI data in combination with a go/no-go task to compare behavioral responses and neural activation patterns. Participants were 40 offending PWP, 37 non-offending PWP, and 40 healthy controls that matched for age and IQ. Within the group of offending PWP, one of every four participants had been imprisoned, while the majority were recruited from the community or the PPD. The presence of other mental disorders was assessed using the Structured Clinical Interview for the DSM (SCID; Wittchen et al., 1997), and global intelligence with four subtests of the 4th edition of the WAIS (Von Aster et al., 2006). Participants were performing a go/no-go task during the examination since the authors wanted to assess the response inhibition ability (Kärgel et al., 2017). The authors observed that the WAIS scores of the P+CSO group and the P-CSOs (marginally) were negatively correlated with error-to-go trials. In HC, age was positively correlated to reaction time to go trials, while WAIS scores showed a negative correlation. However, the findings did not survive Bonferroni correction. A strong response inhibition ability requires the engagement of a frontoparietal control network (FPCN). This is a large brain network that encompasses the DLPFC and the posterior parietal cortex and plays a central role in executive control (Dixon et al., 2018). Analyzing the go/no-go paradigm, compared to non-offending PWP, offending PWP had a higher rate of commission errors, suggesting an inferior inhibitory control and, indeed, showing a weaker activation of the FPCN; but both groups did not significantly differ from HC (Kärgel et al., 2017). This led the authors to suggest that non-offending PWP had stronger self-control, instead of offending PWP being more impulsive. The medial parietal

cortex left caudal PCC (posterior cingulate cortex), and left SFC (superior frontal cortex) showed a decrease in the activation among offending PWP compared to non-offending PWP. The PCC is correlated with response inhibition and is part of the DMN, but just like it's supposed to be, its activity decreased during the challenging no-go condition while increasing during go tasks in offending PWP. This result might indicate a dysfunctional activation pattern of the FPCN among offending PWP during more challenging tasks. On the other hand, non-offending PWP seem to have learned a compensatory mechanism that adequately engages the FPCN (Kärgel et al., 2017). The results indicate that an appropriate activation of the FPCN may prevent PWP from offending, and this theory needs to be further investigated. The left SFC is part of the FPCN, it has a memory function and showed a similar pattern of activation. Once again, this study suggests that reduced response inhibition ability does not characterize pedophilia per se, on the contrary, a strong inhibition control, and an appropriate engagement of the FPCN may prevent people with pedophilia from offending. Groups, however, did not differ in the activation pattern of prefrontal areas, and the lack of executive dysfunctions is in contrast with prior studies (i.e., Suchy et al., 2009). Nevertheless, none of the previous researchers had controlled the influence that the status of incarceration had on participants (Kärgel et al., 2017). Non-offending PWP did not differ in any measures compared to HC, but neither offending PWP compared to HC reached significance. Previous studies did not distinguish offending from non-offending PWP, while this is one of the strengths of this research. However, having a non-pedophilic CSO group could have been an important addition that could have clarified the results (Kärgel et al., 2017).

Weidacker et al. (2022) recruited 11 P+CSOs, 8 P-CSOs, and 10 controls to examine event-related functional magnetic resonance data of the groups while performing a color-word Stroop task (1935). The Stroop task is a neuropsychological paradigm first introduced by John Ridley Stroop in 1935, used to measure the ability to inhibit cognitive interference (Scarpina

& Tagini, 2017). The paradigm requires the presentation of a list of words (which are names of colors) that participants have to read in the shortest time possible; these words are either printed in black or color (Scarpina & Tagini, 2017). The paradigm is characterized by congruent (C) and incongruent trials (IC), participants are required to name the color of the ink during the latter while being asked to read the words during the first (Scarpina & Tagini, 2017). Reading the word is an automated task, thus participants take longer to name the ink of the words while inhibiting the automated response (Scarpina & Tagini, 2017). The psychopathology, sexual interests, and intelligence were assessed using a semi-structured interview of the DSM-IV, the Kinsey scale (Kinsey et al., 1948), and a brief version of the WAIS-IV (Wechsler, 2008b). Groups were matched for age, FSIQ, and handedness (Weidacker et al., 2022). Response time during the Stroop task was affected by age and FSIQ. The authors observed that P+CSOs had longer RTs in IC trials compared to both P-CSOs and HC. Just like prior findings (Kärgel et al., 2017), the results suggest that weaker inhibitory control and the offense status are dependent, thus that inhibitory deficits are independent of pedophilic preferences (Weidacker et al., 2022). Moreover, during IC trials, the P+CSO group showed greater activation of the SPL (superior parietal lobe) and precentral gyrus/SMG (supramarginal gyrus) when compared to P-CSOs (Weidacker et al., 2022). Both SMG and SPL are involved in shifting focus and attention, therefore the increase in their activation indicates that P+CSOs find it more difficult to shift attention away from dominant tendencies, suggesting that people incarcerated for sexual offenses are more susceptible to interference. Moreover, only among P+CSOs, increased susceptibility was also positively correlated with increased angular gyrus activation. The angular gyrus is involved in memory-guided attention and it is active when actions are to be suspended. Whether the activation of this area depended on the rarity of IC trials (the majority were congruent trials), or the constant need to update memory because of the frequent switching, this finding should be further investigated. The

cerebellum and the left angular gyrus were more activated during error trials among P+CSOs compared to HC. The left angular gyrus is involved in semantic processing, therefore, during the Stroop task its activation increases while executing a fast automated response and decreases during IC trials. The cerebellum takes part in language processing and divided attention, thus its hyperactivation during error trials led to enhanced word reading and a higher rate of erroneous responses among P+CSOs. Concerning post-error slowing (PES), which is the “tendency of participants to slow down on the current trial after having committed an error on the previous trial” (Ruitenberg et al., 2014, p. 1), P-CSOs showed greater left IFG (inferior frontal gyrus) activity compared to HC, and enhanced left-hemisphere posterior cingulate, precuneus, and middle temporal gyrus activity when compared to P+CSOs (Weidacker et al., 2022). These areas are part of the DMN. Unfortunately, the association between this finding and pedophilic preference or offense status is not clear, since studies on it are missing (Weidacker et al., 2022).

The study presented some limitations: the sample was small and some of the subjects belonging to pedophilic groups were not exclusively attracted to children (Weidacker et al., 2022).

Table 4*Summary of fMRI studies*

Authors	Sample	Paradigm	Findings
Sartorius et al. (2008)	10 offending PWP 10 healthy controls	Oddball paradigm	<ul style="list-style-type: none"> ▪ Hyperactivation of the amygdala
Habermeyer & Händel (2013)	11 offending PWP (abuse or child pornography) 8 healthy controls	Go/no-go task	<ul style="list-style-type: none"> ▪ Typical activation of areas involved in response inhibition → Attentional problem rather than impulsivity ▪ Hyperactivation of the DMN during more challenging tasks
Poepl et al. (2015)		Diversified tasks and resting state functional connectivity	<ul style="list-style-type: none"> ▪ Brain areas activated during sexual arousal: left extrastriate cortex, DLPFC, hippocampus, SPL, amygdala, thalamus, midbrain, anterior insula ▪ Brain areas deactivated during sexual arousal: left TPJ and STG
Kärgel et al. (2015)	14 non-offending PWP 12 offending PWP 14 healthy controls	Resting state functional connectivity	<ul style="list-style-type: none"> ▪ Concerning P+CSO <ul style="list-style-type: none"> ○ Hypoactivation FC of OFC, DMPFC, amygdala-inferior temporal cortex, from amygdala, OFC, ACC, medial PFC
Cantor et al. (2016)	37 offending PWP 28 non-pedophilic offenders 38 healthy controls	Resting state functional connectivity	<ul style="list-style-type: none"> ▪ Concerning P+CSO <ul style="list-style-type: none"> ○ Greater FC between DMN and brain areas ○ Different FC pattern of brain areas of SRN
Kärgel et al. (2017)	40 offending PWP 37 non-offending PWP 40 healthy controls	Go/no-go task	<ul style="list-style-type: none"> ▪ Concerning P+CSO <ul style="list-style-type: none"> ○ Inferior inhibitory control ○ Weaker activation of the FPCN ○ Hypoactivation of the medial parietal cortex, left caudal PCC and left SFC ▪ Concerning P-CSO <ul style="list-style-type: none"> ○ Stronger self-control ○ Presence of a compensatory mechanism that adequately engages the FPCN

Weidacker et al (2022)	12 offending PWP 8 non-offending PWP 10 healthy controls	Stroop task	<ul style="list-style-type: none"> ▪ Concerning P+CSO <ul style="list-style-type: none"> ○ Longer RTs in IC trials ○ Greater activation of the SPL and precentral gyrus/SMG ○ Greater activation of the cerebellum and the left angular gyrus during error trials ▪ Concerning P-CSO <ul style="list-style-type: none"> ○ In relation to PES, greater left IFG activity compared to HC, and enhanced left-hemisphere posterior cingulate, precuneus, and middle temporal gyrus compared to P+CSO
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4.3.1. Conclusions of fMRI Studies

The studies have brought to light interesting results. There seem to be structural abnormalities and functional differences in brain areas of the frontal lobe, such as the OFC and the DLPFC, concerning gray matter volume, surface area, and functional connectivity (Habermeyer et al., 2013; Kärgel et al., 2015; Lett et al., 2018; Poepl et al., 2013; Schiffer et al., 2007).

Schiffer et al. (2007) and Poepl et al. (2013) compared offending PWP with healthy controls, while Kärgel et al., (2015, 2017); Weidacker et al., (2022) distinguished between offending and non-offending people with pedophilia, and the results indicated that the two groups have different patterns of connectivity that distinguish them and modulate their behavioral response. This distinct pattern makes non-offending PWP have stronger self-control and compensatory mechanisms that prevent them from offending. One more interesting finding concerns the Default Mode Network, which is hyperactivated during more challenging tasks among offending PWP (Cantor et al., 2016; Habermeyer & Händel, 2013). Researchers have collected enough data to conclude that some functional and structural conditions can either increase or decrease the likelihood of offending children. Future research should distinguish offending and non-offending PWP, also including in the sample a group of people without pedophilia who abused children. Comparing these groups and

healthy controls could help clarify the relationship between the findings discovered until now, the offense status, and pedophilic preferences.

The results are promising and encourage investigating the role of brain networks in this field. Numerous studies have shown that functional connectivity can be influenced by psychotherapy. Mason et al. (2016) conducted a systematic review on the effects that Cognitive Behavioral Therapy (CBT) has on functional connectivity, considering that most psychiatric disorders are characterized by dysfunctional connections. The authors collected clear evidence that FC can be altered by CBT (Mason et al., 2016). In a recent study on Borderline Personality Disorder (Sampedro et al., 2022) it was demonstrated that mindfulness can modulate FC, improving the patient's ability to control their emotions. Given these results, I wonder how relevant could psychotherapy be to PWP. Psychotherapy could not only help patients cope with and accept their atypical sexual preference, which can give rise to guilt but could also modulate FC, thus preventing possible abuses. As I have already mentioned, the stigma against pedophilia is particularly ingrained in individuals, including psychologists, but research demonstrates the importance of targeted and inclusive intervention.

CHAPTER 5

Idiopathic and Acquired Pedophilia

Idiopathic and acquired pedophilia seem to be two distinct disorders. Idiopathic pedophilia is developmental pedophilia, the psychiatric disorder described by both the DSM and the ICD. On the other hand, acquired pedophilia refers to sexual interest and urge toward prepubescent children caused by an evident underlying neurological condition, for instance, brain lesions or tumors (Camperio Ciani et al., 2019). The onset corresponds to the insurgence of the alteration, which makes the individual develop an erotic preference toward children and makes them act on their urges (Camperio Ciani et al., 2019). Intriguing is the difference in the *modus operandi* between individuals with the two disorders: people with idiopathic pedophilia show a predatory style (Scarpazza et al., 2021), they thoroughly plan their actions and lure the kid into trusting them and become friends with them (Camperio Ciani et al., 2019). This finding is in line with previous studies on brain functional alterations, which showed that people with pedophilia have stronger planning ability and abstract reasoning skills compared to non-pedophilic people (i.e., Eastvold et al., 2011). On the contrary, people with acquired pedophilia lack premeditation and organization, therefore, seem to be made distinctive by an impulse dis-control (Camperio Ciani et al., 2019). In addition, their behavioral profile is characterized by the old age of onset, the absence of prior psychiatric disorders and sexual offenses, spontaneous confession, and a strong sense of guilt (Camperio Ciani et al., 2019). From a legal perspective, it sometimes happens that individuals with acquired pedophilia are considered not guilty by reason of insanity, which means that they are not considered responsible for the offenses involving pedophilic behavior that they are charged with (Scarpazza et al., 2018). When assessing mental insanity, professionals should not only corroborate the presence of an organic condition but also verify the individual's

cognitive and affective abilities (Scarpazza et al., 2018), since they typically cannot understand the social disvalue, severity, and immorality of their actions (Sartori et al., 2016).

Scarpazza et al. (2018) led a meta-analysis to identify the neurological alterations associated with the two forms of pedophilia, whether they share the same underpinnings, and if these alterations led to pedophilia-specific psychopathological features. The authors collected 17 papers on acquired pedophilia and 19 articles on idiopathic pedophilia. Despite the heterogeneity of lesion location concerning acquired pedophilia, the mapping analysis of the lesion network showed that they were all functionally connected with a resting state network that included OFC areas, left fusiform gyrus, posterior midline structures, and the right inferior temporal gyrus. The same results often have been reported in single case studies and are coherent with the behavioral profile and *modus operandi* that characterize individuals with acquired pedophilia. Posterior midline structures and the right OFC are involved in social cognition, theory of mind, and emotion recognition; therefore, impairment in these areas would explain why individuals cannot discern moral and immoral actions. The right OFC also plays a role in impulse control; dis-inhibition and dis-control are characteristics that represent them. On the contrary, the authors have not found any specific altered brain activity associated with idiopathic pedophilia. Results revealed only a few spatially convergent clusters in the middle occipital gyrus, middle cingulate, and superior frontal gyrus, but only when lowering the statistical threshold. One specific problem related to idiopathic pedophilia is the oftentimes presence of comorbidities, which makes it harder to distinguish whether neuropsychological and biological alterations are associated with pedophilia or any other psychiatric disorders (Scarpazza et al., 2018).

Research on acquired and developmental pedophilia has come to important conclusions: the results support the theory that acquired pedophilia shares a common neurobiological substrate; using neurological disorders to examine psychiatric behavior is not always relevant

and investigating the differences between two seemingly similar disorders can help researchers shape useful therapeutic and rehabilitative programs (Scarpazza et al., 2018).

The sample taken for this meta-analysis included, among others, both PWP who offended and who did not offend. However, looking into the studies that compared offending and non-offending PWP (i.e., Kärgel et al., 2017; Lett et al., 2018; Schiffer et al., 2017), it can be noted that people with acquired pedophilia share some of the same altered brain structures and neural networks with pedophilic convicted men. It would be interesting to specifically investigate whether people with acquired pedophilia and offending PWP share the same neurological underpinnings.

CHAPTER 6

Treatment and Prevention Projects

It is always important to remember that most treatment programs target offending PWP, and just recently some researchers and scholars across the world have created intervention and prevention programs aimed at preventing sexual abuse by helping people with pedophilic tendencies who fear harming a child. The main goal is to prevent child sexual abuse and adolescents or adults who are more prone to harm a child are the target groups of these programs since it is known that having pedophilic tendencies increases the likelihood of engaging in harmful behaviors toward children. PWP lack services/programs and fear being judged or reported to the police. In Italy, it seems that the terms pedophilia and child sexual abuse are still considered synonyms. The misuse of the word has certainly increased the stigma toward pedophilia and may have made it more difficult to develop programs or helplines. In Italy, it seems that only private psychotherapists interested in the matter are willing to provide help, while there are no organizations, centers, or hotlines available.

Concerning offending PWP, Stinson & Becker (2016) described four different types of treatment for pedophilic disorder: psychosocial treatments, pharmacological treatments, Circles of Support and Accountability (COSA), and randomized clinical trials. Research demonstrated that treatments should focus on behavioral and cognitive training related to attention and self-control. The findings attained from existing literature indicate that offending PWP lack several cognitive and behavioral skills, therefore these treatments could help them improve them.

Concerning non-offending PWP, prevention projects now exist, such as the "Help Wanted Prevention Project" in Massachusetts, the "Prevention Project Dunkelfeld" in Berlin, or "Stop it now!", which is an organization started in the U.S. that has since spread to Belgium, the Netherlands, Germany, and the UK. No specific findings have highlighted any differences

between non-offending PWP and healthy controls, but several qualitative studies collected information on personal and private experiences that individuals must face when becoming aware of their sexual preferences. They describe overwhelming feelings of loneliness, depression, hopelessness, and anxiety; thus, prevention programs should focus on emotional support, which could help them accept their condition and prevent child sexual abuse.

6.1. Treatments for offending People With Pedophilia

Psychosocial treatment focuses on teaching the person to control their behavior and sexual urges. Researchers noticed that PWP have deficits involving self-control and inhibition; thus, they thought that people could be conditioned to modulate and manage their sexual drive through CBT, which is the most common treatment in operation (Stinson & Becker, 2016). CBT targets “deviant sexual arousal, distorted cognitions, pro-offending attitudes, impulse control deficits, social skills deficits, poor emotional regulation, environmental triggers, and behavioral components like masturbatory reconditioning, covert sensitization, or olfactory aversion therapy” (Stinson & Becker, 2016, pg. 19). In addition, CBT can alter connectivity between brain regions (Mason et al., 2016; Sampedro et al., 2022). Considering that PWP – especially offending PWP - show patterns of brain dysconnectivity, CBT could be very useful. Nevertheless, the positive impact of CBT on this disorder is hardly demonstrated by research, and its effect on recidivism seems inconclusive or negative (Stinson & Becker, 2016). Some scholars sustain that CBT would be more effective if it followed the Risk Need Responsivity (RNR) model (Hanson et al., 2009). The model states that treatment programs should be calibrated to the individual risk of offending, with more intense programs for people at higher risk, and less intense ones for people at lower risk (Stinson & Becker, 2016).

Relapse prevention is an approach based on CBT whose goal is to prevent recidivism by helping the person with pedophilia identify risk factors and triggers that could increase the likelihood of re-offending (Stinson & Becker, 2016).

Pharmacological therapies are commonly used in combination with other treatments, and they consist of the use of hormonal treatments or Selective Serotonin Reuptake Inhibitors (SSRIs). The first ones are thought to reduce the sexual drive by lowering testosterone levels, while they do not redirect the object of the patients' interest (Stinson & Becker, 2016). SSRIs decrease people's sexual urges, impulsivity, and obsessiveness, typical characteristics of paraphilic disorders, and increase their mood (Stinson & Becker, 2016). Nevertheless, several problems have risen that concern the use of medications: the incurrence of severe side effects, the ethicality of their use, and the patient's compliance with treatment (Stinson & Becker, 2016).

The Circles of Support and Accountability (COSA) model has proved to have many positive effects on recidivism (Duwe, 2012). People who undergo this program are visited day after day by volunteers who assist them in their daily life, mediate their relationship with authorities, the public, or the media and are aware of the characteristics of the disorder, its triggers, and risk signals (Stinson & Becker, 2016). The likelihood of re-offending significantly decreases after participating in the program (Stinson & Becker, 2016).

6.2. Prevention Programs: Helping Non-offending People With Pedophilia

Shields et al., (2020) conducted qualitative research by interviewing 30 young adults between 18 and 30 years old who had experienced sexual attraction to prepubescent children but never committed abuse toward children. Of these, 12 of the participants did not consider themselves a threat to children. The authors wanted to collect qualitative data on the personal experience of PWP and use this piece of information to structure a prevention program. Using

a constructivist approach as a theoretical basis, the researchers conducted telephone interviews asking participants the age when their interest in children developed, how and what they felt, and what resources might have helped them cope. Lastly, participants completed an online survey to collect quantitative data on demographic information, sexuality, and childhood experience (Shields, Murray, et al., 2020). Interviews were transcribed and researchers were divided into different coding teams across three distinct phases of analysis (Shields, Murray, et al., 2020). Participants described the moment they realized they were attracted to children as extremely confusing. They did not exactly understand the meaning of their sexual interest, and only later they considered themselves pedophiles. After realizing the truth, they were affected by the way the media portrayed pedophilic people. Participants thought their future was already written, they thought they would eventually harm a child and turn into the "Monster" that the media described. They felt hopeless, and just being attracted to children had already made them monsters, even though they had never gotten close to a child. This intrusive and persistent fear of harming someone and the fear of being rejected or ostracized, made them develop feelings of depression and anxiety, and led them into pushing friends and relatives away. Three resources could have helped them cope with their atypical attraction: having positive roles, feeling supported, and receiving positive messages. Having the opportunity to know other people who felt attracted to children and conducted a happy, non-offending life, could have helped them greatly. Moreover, a more positive message from society itself, and access to safe and legitimate resources for people who struggle with this sexual attraction would have been helpful (Shields, Murray, et al., 2020).

The information collected through the research (Shields, Murray, et al., 2020) helped the authors shape the prevention project, called the Help Wanted Prevention Intervention. It is supported by the Moore Center for Prevention of Child Sexual Abuse at Johns Hopkins Bloomberg School of Public Health. I had the opportunity to talk directly to one of the main

developers, Ryan Shields, who helped me understand the goal of the project and how it was born. The program consists of online courses that help young adults and adolescents attracted to prepubescent children live happy, non-offending lives (Shields, Letourneau, et al., 2020). Ryan Shields described it as an informative tool that people use to have access to specific and non-judgmental information on their condition. The project promotes understanding, self-esteem, self-acceptance, and abstention from judgment, while also providing useful and practical coping strategies. The website ensures anonymity, guarantees privacy, and increases a sense of trust. The individuals themselves choose independently to conduct the online course, in their own time and manner, without having to deal with outside people whose judgment they might fear.

The project is succeeding and providing effective help. I respect and appreciate the work that Letourneau, Shields, Ruzicka, their collaborators, and funders have conducted so far, and I think it could be a great benchmark for the development of similar projects on the Italian territory.

Conclusions

Pedophilia is a psychiatric disorder and is one of the most stigmatized mental disorders. This stigmatization derives from the oftentimes confusion that characterizes the terms pedophilia and child sexual abuse, which are used as synonyms by society, the media, and sometimes scholars. Most of the general population is not aware that pedophilia is a mental disorder and they attribute to it a legal connotation when they intend to talk about child sexual abuse. Both the DSM and the ICD affirm that people with pedophilic disorder do not necessarily act on their sexual urges. This opens a debate on the difference between offending and non-offending PWP. My thesis wanted to investigate the differences between these two groups and try to give tools to distinguish them from non-pedophilic people convicted of offenses against children. There is evidence that pedophilia is caused by neurodevelopmental perturbations, this hypothesis is supported by several studies that highlighted the correlation between the disorder and head injuries, left-handedness, specific phenotypic features, lower levels of intelligence, altered brain functions, and structures.

My thesis' strength resides in its attempt to cover and collect the findings of as many papers as possible. To my knowledge, all manuscripts on the association between pedophilia and executive functions were described here, and of each one of them assets and limitations were acknowledged. What matters is having outlined the sample of each study because it shaped and influenced the interpretation given of the results by the authors. It can be noticed that each group is marked by distinct strengths and weaknesses concerning executive functions. For instance, people who engage in sexual offenses against children struggle with control inhibition, independently of their preferred age. This means that a deficit in control inhibition is something that characterizes sexual abuse in general. Non-pedophilic men who abused show a weakness in WM, and pedophilic men have better set-shifting abilities and planning skills. These findings led to the hypothesis of a specific neuropsychological profile

and are in line with each group's *modus operandi*. Studies on structural brain alterations have demonstrated differences among pedophilic men in frontal, temporal, and limbic areas. Moreover, research using functional magnetic resonance imaging found evidence that functional connectivity is disrupted in several brain regions that included frontal, temporal, and limbic areas as well. The deficit in functional connectivity and the structural alterations can explain why each group has those specific strengths and weaknesses.

This helped to outline the difference between non-offending people with pedophilia, offending people with pedophilia, and people convicted of offenses against children without pedophilia. Moreover, every study has given pieces of information on the kind of intervention and prevention programs that would be most beneficial to each group, and it is of utmost importance for our society to use the data collected to help them all. It is relevant to remember that helping each group can prevent child sexual abuse and recidivism, and can support the individuals in living happy, satisfying, non-offending lives.

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