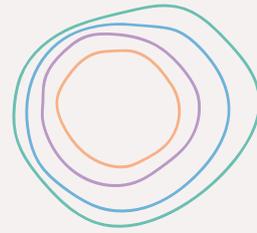


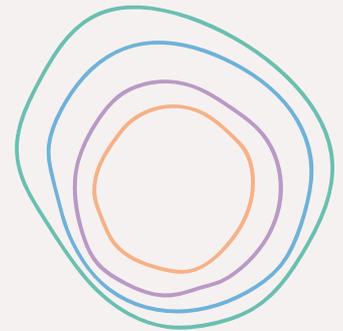


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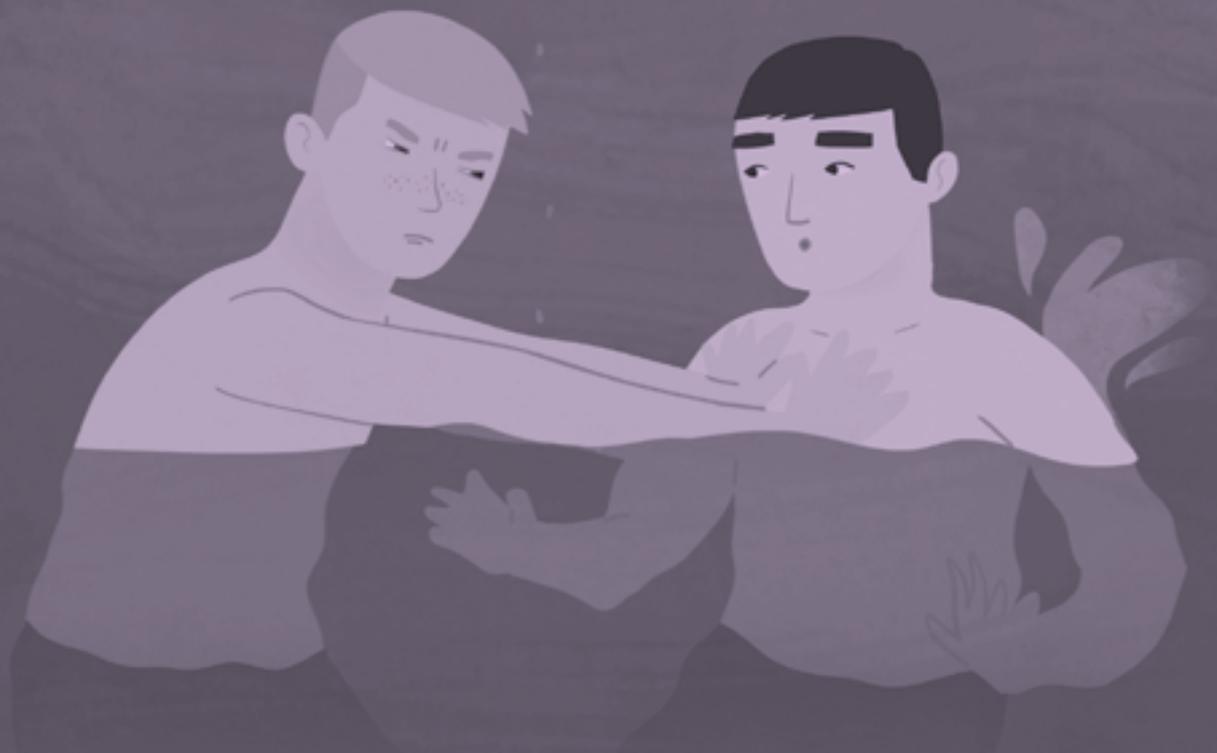


Childhood Trauma and the Brain — Deep Dives

What happens when relationships go wrong?



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Key messages

- Childhood trauma, in the form of maltreatment, can lead to **long-lasting changes in the brain**.
- These changes are not necessarily 'damage' - rather they can reflect how a child has **adapted** to living in an unpredictable and dangerous home environment.
- Changes have been shown in brain systems involved in detecting **threat**, processing **reward**, as well as personal (autobiographical) **memories**.
- These changes may be helpful for a child in these early environments but become **less helpful** later in more **ordinary environments**, such as school – increasing vulnerability to emotional and behavioural problems.

What is childhood maltreatment?

There are many definitions of childhood maltreatment. We can think of it as any form of behaviour that violates a child's dignity or poses a threat to their physical and emotional well-being. Unlike other types of early adversity or single traumatic incidents – such as poverty, illness or loss of a family member – childhood maltreatment occurs primarily in the context of relationships of power and trust – such as those with parents or caregivers.

Childhood maltreatment has commonly been subdivided within two main categories:

1. Acts of commission include physical, sexual and emotional abuse.
2. Acts of omission, such as emotional and physical neglect, include psychosocial deprivation and the systematic failure of a caregiver to protect a child and prevent harm.

Witnessing domestic violence has also increasingly been recognised as a form of maltreatment. Different maltreatment types tend to co-occur and overlap for the majority of children who experience them.^[1]



How common is childhood maltreatment?

A substantial minority of children experience abuse and neglect while growing up. We do not know the exact number as maltreatment often goes unreported or is hidden from view. In high-income countries, such as the UK, it has been estimated that about one in five children experience a form of maltreatment during childhood.^[2] A larger proportion of adults report having experienced significant abuse and neglect during development.

The impact of childhood maltreatment on brain development

The brain is highly influenced by our early experiences, and in particular early relationships. All children require nurturing adults who care for and value them – attending to their physical, emotional and social needs, and protecting them from danger. There is no such thing as a perfect parent. However, when adults grossly fail to provide a 'good-enough' early environment – which is nurturing, safe, consistent and stimulating – the consequences on brain development can be profound.

Alterations in brain development following childhood maltreatment have sometimes been interpreted as a sign of 'damage'. While this may happen, following extreme neglect for example, other brain changes can arise as a result of adaptation. That is, children (and their brains) adapt to cope and survive in dangerous and unpredictable environments. The plasticity of our brain allows us to learn and find new ways to cope in such conditions. We will look at three examples below in relation to threat, reward and autobiographical memory.



Latent Vulnerability

While brain changes described above may have short-term advantages, they can have negative consequences in the long-term. They may mean a child has more difficulty in adjusting to and navigating more predictable environments, such as a stable and safe foster placement or school. Over time, this can increase the risk of later mental health problems. We call this “latent vulnerability”. Such vulnerability may not be immediately obvious but unfolds over time, in part through the child’s social relationships. Research has observed brain changes following experiences of abuse and neglect in several brain systems; here we focus on the threat processing system, the reward processing system and the autobiographical memory system.

Threat processing

The threat-processing system in our brain allows us to detect and respond promptly to danger (e.g. fight-or-flight responses). We can avoid a fast-approaching vehicle on the road or quickly brush off a spider on our shirt. Stress and threat are a normal part of life. However, abuse and neglect

create a world where danger is unpredictable and punishment can be extreme. Research has shown that exposure to domestic violence, neglect and physical abuse can lead to long-lasting alterations in how the brain responds to danger.^{[3][4][5]}

Changes to the threat system can lead to two outcomes – a pattern of hypervigilance to threat and/or of excessive avoidance.

Hypervigilance

Children exposed to abuse and domestic violence are better at identifying anger in other peoples’ faces and show heightened brain reactivity to angry faces in several brain structures, including the amygdala and insula.^{[4][5]} Recent research suggests neglect can have the same impact.^[6] We see similar patterns of brain activation in soldiers after exposure to combat. This indicates that such brain alterations may have an adaptive value for children exposed to early adversity – helping them spot potential danger early. We are all likely to show such brain changes if we find ourselves in a dangerous environment.

We believe that this increased brain reactivity to threat comes at a cost. It may mean a child does not deal as well with social challenges as their peers when in more everyday environments. For example, it may create a perceived sense of impending danger, reducing the attentional resources available to develop other important skills or attend in class. It may also lead children to respond inappropriately to interactions with others in ways that lead to conflict.

Crucially, increased neural reactivity to threat has been shown to occur outside conscious awareness.^[3] Thus, regulating emotional



reactivity and hypervigilance can represent an especially challenging task for some children that have experienced maltreatment. This may help us to understand why at times overt behaviour may appear erratic and unpredictable.

Avoidance

Experience of maltreatment can also lead to the opposite pattern – low brain activation to threat.^[6] This has been understood as consistent with avoidance and even dissociative responses to danger. In the short-term, this might be a useful coping strategy for the child, helping them to regulate their emotions if they cannot escape from abuse. However, it can also lead to a child becoming withdrawn or anxious even in safe environments, reducing opportunities to learn and build relationships. Over time, this can lead to emotional and behavioural problems.

Reward processing

From the earliest years, our brain is able to learn what is rewarding in the world and how to behave in ways to be more likely to experience rewards – a mother's smile, a cuddle, as well as basic rewards such as food.

An important chemical in the brain, called dopamine, helps the communication between different brain regions responsible for the processing of reward. These include deep brain structures which we share with other animals, such as the brainstem and the striatum, as well as more frontal regions of our brain which are uniquely human, such as the orbitofrontal cortex which sits just on top of our eye sockets. For many children exposed to maltreatment, the family environment is characterised by inconsistent rewards or the lack of rewards. For example, emotional warmth may be rare,

there may be little praising of effort, and even sometimes a lack of food. We believe that this may reduce the brain's responsiveness to rewards later on. That is, a child who has experienced abuse and neglect seems to show reduced response to reward than their peers.^{[7][8][9]}

When living in a home where there is neglect, for example, reduced response to reward may be adaptive as it may help the child to regulate the impact of constant disappointment. In the long-term, however, it may lead to reduced motivation and differences in how rewards are experienced. This can have important implications for how a child builds and maintains relationships with others, as well as how they apply effort to meet challenging goals. Science suggests that over time this can increase the risk of depression.

Autobiographical memory

Memory can serve different purposes. One crucial aspect of memory is that it helps us negotiate the future! We are always able to find our way home because we have travelled the route many times before. Equally, we can build and maintain relationships with other people because of what we have learned about interacting with others in the past.

Autobiographical memory is our memory of our own personal experiences. We rely on memories of these past events to help us navigate novel tasks, challenges and social situations. When we move to a new school or a new workplace – or even meet someone on the bus – we all refer back to previous experiences (often outside of our conscious awareness). These past experiences help us deal better with such new experiences. What strategies have been useful in the past? What strategies have not been so helpful?



Simply put, our autobiographical memory system allows us to learn from our experiences. Indeed, numerous studies have shown that autobiographical memory is important for our ability to plan, problem-solve, make decisions, regulate our emotions and promote the development of a positive sense of self.

Childhood trauma, in the form of abuse and neglect, can affect how children process autobiographical memories.^[10] Brain structures such as the hippocampus have been implicated in this process.^[11] These changes mean that a child may be less able to recall personal memories in a detailed and vivid way. This is called overgeneral autobiographical memory. This might help the child when dealing with negative memories of the past that they may wish to 'push away' because they make them feel bad. Over time this can affect recall of all memories, even positive ones.

Neuroscience studies have shown that childhood maltreatment is associated with differences in brain activation when recalling everyday memories. One interpretation of these findings is that negative memories are more salient – that is, more prominent and likely to spring to mind. By contrast, there is some indirect evidence that positive memories may be less well specified.^[11] In summary, these changes may make it harder for children who have experienced abuse and neglect to draw on past experiences to help with new social situations. As a result, they may not deal with social situations as well. Brain changes may also make it more likely that they focus on negative rather than on positive memories. This may over time increase the risk of depression, and the risk of building a negative picture of themselves.

Is it just in the brain?

Despite the long-lasting impact that childhood maltreatment can have on the brain, many children who experience abuse and neglect can have a resilient outcome and live fulfilling lives. This is because, despite having experienced early adversity, there can be internal and external protective factors that promote a resilient outcome. Most important are a child's relationships – with their carers, teachers, and peers. It is important to remember that the brain is not only responsive to negative experiences, but also to positive ones.



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