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Review Article

Giftedness and mirror neurons[1]

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Abstract

This article explores the strong connection between giftedness and hyperactivity of mirror neurons (hypermirroring). It challenges the widespread prejudice — still prevalent even among educators and psychologists — that high cognitive ability is frequently accompanied by emotional underdevelopment. Drawing on neuroscience, the author argues that many characteristics of gifted individuals, including heightened empathy, emotional intensity, rapid observational learning, overexcitabilities (Dabrowski), asynchronous development, and sensory hypersensitivity, can be largely explained by an exceptionally active mirror neuron system. This system enables gifted people to automatically and intensely "mirror" the actions, emotions, and intentions of others, leading to superior social intuition and emotional intelligence on one hand, but also to emotional overload, hyper-empathy, and vulnerability to emotional contagion on the other. The discussion further links hypermirroring to misophonia, presenting it as over-mirroring of orofacial actions rather than a simple sound-processing disorder. Supporting evidence from key studies (Kumar et al., 2021; Stoeckl-Drax, 2020, 2021) is presented, including fMRI and EEG findings. The author concludes that cognitive giftedness and high emotional intelligence are often complementary rather than contradictory. Proper understanding of the mirror neuron mechanism can help parents, educators, and professionals better support gifted children and adults, moving beyond outdated stereotypes toward more effective educational and emotional interventions.

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Introduction

A few years ago, I was invited to a meeting whose purpose was to determine whether a girl, whom a psychologist working in the public service had recommended should skip two grades at once, would indeed be "approved" by representatives of the Ministry of Education to do so. The acceleration assessment, to which I referred the girl's parents, was a last resort because all other solutions the parents and the school had tried had failed. The girl, who was in a gifted class, was extremely unhappy with both her studies and the social environment in the class and was frequently absent from school.

Despite the unequivocal recommendation that skipping a grade would improve the girl's emotional and social situation, the "authorities" refused to allow her parents to register her in the recommended class. The meeting, scheduled for August 31 of that year, was intended – from the Ministry of Education's perspective – to persuade the parents to give up the double skip, while for the parents it was an attempt to convince the Ministry's representatives to accept the psychologist's recommendation. I will not bore you with the details of the meeting; the decision will be presented soon.

[1] This work is based on four of me Hebrew publications (Web1, Web 2, Web3, Web 4)
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The point I found most interesting in the meeting was the main reason for the opposition presented to us by "the other side." The professional, a high-ranking public official, justified her opposition to the grade skip with the following sentence: "I myself have a gifted daughter, and as we know, gifted children are not developed emotionally."

This prejudiced view is unfortunately still widespread today, even among professionals in education and psychology. I will not uproot it entirely, but I will try to help readers see things from a different angle – the perspective of neuroscience – and perhaps convince them that cognitive giftedness does not contradict high emotional intelligence; in many cases, the opposite is true.

Gifted children, gifted adolescents, and adults with high cognitive abilities often show high sensitivity not only to themselves but also to others, along with strong social awareness. This fact may be related to a particularly active mirror neuron system that functions at an exceptional level. Mirror neurons are brain cells that are activated both when performing an action and when observing someone else performing it. They enable understanding, empathy, and social learning. They reflect the actions of others and help decode intentions and emotions (such as pain or joy) through automatic mental simulation, thus forming the basis for human communication and imitation. They also enhance learning, which occurs to a large extent through imitation, by "lighting up" when we observe another person's actions or emotions. This enhanced ability allows for deeper emotional connection and intense, rapid learning, but it can also lead to oversensitivity, which often works against the child, teenager, or woman.

The main connections between giftedness and mirror neurons are actually links between different – emotional and cognitive – components, all of which have been researched and some even measured, according to various definitions of giftedness. All these components have been explained in many ways. However, since the discovery of mirror neurons at the end of the 20th century, most of them can be explained under the "umbrella" of mirror neurons. Here are the central links between giftedness and mirror neurons:

Emotional Intensity and Empathy: Gifted children and adolescents may activate an enhanced mirror neuron system, leading to exceptionally high empathic ability – that is, the ability to feel others' emotions deeply. This sometimes results in high social involvement. For example, we often find gifted children – especially gifted girls – who channel their high abilities in understanding others into social issues and/or intense interpersonal relationships, rather than into realizing their high cognitive potential.

The main reason for gender differences in this area is emotional, especially social and reward-based, not that girls have higher emotional abilities. There is actually great similarity between the personality characteristics of gifted boys and gifted girls. Gifted girls often do not receive social rewards for exceptional cognitive achievements, whereas they are praised for social activities and receive sympathy from their peers and adults. The focus on intense interpersonal relationships is also characteristic of gifted girls and can often be seen among gifted adolescent girls who enjoy mature relationships at a young age.

Rapid Learning: Giftedness is often associated with efficient sensory-motor processing. Mirror neurons, located in areas such as the inferior frontal gyrus and the superior temporal sulcus, allow gifted individuals to learn complex behaviors through observation alone, greatly accelerating skill acquisition. Mirror neurons "fire" not only when we act but also when we see someone else perform it. Learning through vision occurs through the repetition of actions, the generalization of movement patterns, techniques, and action sequences, and the understanding of abstract concepts. In gifted individuals, this system is more efficient than in those with lower cognitive abilities, as they do not need to repeat actions and skills as often (such as playing music, learning a language, or solving mathematical problems). Sometimes one or two observations are enough.

More Efficient Sensory-Motor Processing: Many gifted individuals exhibit faster processing between sensory and motor brain areas, including the inferior frontal gyrus and the superior temporal sulcus, which contain mirror neurons. This enables faster conversion of visual/auditory information into motor/cognitive action, less "neural noise" (the system focuses on relevant patterns and ignores distractions), and the creation of stronger and faster neural connections following observation.

Learning and Internalization of Complex Patterns and Systems: Mirror neurons are also involved in understanding intentions, goals, and logical sequences. Gifted individuals tend to "feel" the internal structure of a problem or system when they observe someone solving it. This allows them to generalize to new examples quickly, create creative solutions based on what they have seen, and learn meta-skills – how to think, solve problems, and learn – all through observation. This rapid learning and internalization often form the basis for creativity.

Emotional Intensity: The ability of many gifted individuals to feel deep emotions with high intensity is not limited to others; it is also expressed in what is called "emotional learning," which mainly manifests as intense feelings arising from learning itself. This is evident in the extremely high concentration of gifted individuals, in the emotional intensity some feel when learning subjects they love, and in their ability to invest "everything they have" in a beloved subject – sometimes at the expense of other areas – from a young age.

Asynchronous Development: Rapid development of the mirror neuron system may proceed faster than that of other cognitive or emotional areas, contributing to the asynchronous development typical of gifted children, who demonstrate advanced social awareness but struggle to manage complex emotions.

Overexcitabilities: The intensity resulting from enhanced mirror neurons may manifest as sensory or emotional overexcitability (part of Dabrowski's Overexcitability Theory), in which the gifted person experiences the world (sounds, smells, social emotions) with much greater intensity.

Social Challenges: While mirror neurons help in reading others, over-activation can lead to emotional contagion — a state in which a gifted child "absorbs" the stress or emotions of the environment. This can cause fatigue, difficulties in emotional regulation, or emotional exhaustion.

In summary, mirror neurons are like a built-in "fast learning engine" in the brain. In gifted individuals, this engine is enhanced, focused, and more efficient. This enables them to learn quickly through observation, imitation, and intuitive understanding of patterns, but it can also bring emotional overload. A mirror neuron system that responds with great intensity can serve as a central engine for advanced socio-emotional cognitive development and the rapid learning observed in many gifted individuals, while also contributing to the intense nature characteristic of them.

End note: if you are still curious about the girl I described at the beginning, the "authorities" approved the grade skip because there was a problem appealing a recommendation written by "their own" psychologist. However, as a compromise — and so that the girl could start the school year the next day — the parents agreed to the demand that their daughter study in a science class rather than in a gifted class.

Giftedness and Hyperactivity of Mirror Neurons

Hypermirroring (hyperactivity of mirror neurons) is a neurological concept from the third decade of the 21st century. It refers to over-activity or over-representation within the mirror neuron system. In this state, the individual reflects the actions, sounds, or emotions of others with much higher intensity than what is considered "normal."

Research on hyperactivity of mirror neurons falls into two main areas: the role of this hyperactivity in the sensory-emotional condition known as misophonia, and its connection to an exceptionally high level of emotional empathy, or what is referred to in the literature as "emotional giftedness" in children. I will present two articles on the connection between the hyperactivity of mirror neurons and giftedness.

As far as I know, the link between hyperactivity of mirror neurons and giftedness was first presented by the German pediatric neurologist Dr. T. Stoeckl-Drax (Stoeckl-Drax, 2020) at an international conference. Children and adolescents with hyperactivity of mirror neurons were characterized by:

- Executive function difficulties at school, and attention problems mainly at school (not at home)
- Being highly sociable
- Having exceptional empathy abilities
- Possessing good intuition and being very sensitive to others
- Needing "alone time" and "downtime," and sometimes becoming overwhelmed in large groups
- Loving animals and greatly enjoying role-playing games with friends.

The last two points in this list are identical to characteristics of giftedness according to many definitions.

In this work, Stoeckl-Drax presents data on children with high social awareness and high emotional involvement. She bases her research on EEG data — measurement of the brain's electrical activity — and links the hyperactive mirror neuron system to excellent social abilities.

A further article by Stoeckl-Drax (Stoeckl-Drax, 2021) is also based on cases she encountered in her work as a neurologist at a child development institute. It introduces two new concepts that connect the hyperactivity of mirror neurons with giftedness. Both concepts already appear in the title of the article: "EEG Signature" and "Mu Rhythm" [the Greek letter μ].

Hypermirroring is characterized by increased emotional empathy and high social involvement. These characteristics are related to changes in connectivity between neurons in the brain. Stoeckl-Drax used qEEG (quantitative electroencephalogram), which measures and analyzes the brain's electrical activity. She then compared the raw data, converted into color maps, that identified specific brain areas functioning at higher or lower levels than a "normative" database for these children.

The children and adolescents were referred to her clinic due to attention and learning difficulties, as well as feeling overwhelmed in certain situations. At the same time, they demonstrated high empathic and social skills and did not fit any DSM definition.

Factor analysis revealed one factor related to high emotional empathy, increased social awareness, and involvement, which did not correlate with all the other factors (attention, sensitivity, and auditory processing). Analysis of functional connectivity between low and high levels of social involvement showed changes within the mirror neuron network and between the mirror neuron network and the mentalization network, especially in the alpha1 [α1] and gamma [γ] frequency ranges.

Stoeckl-Drax therefore proposes a brief assessment of emotional giftedness based on a single EEG test. This test can provide information about the hyperactivity of mirror neurons and, consequently, about emotional giftedness in children. A by-product of this EEG examination would be information about the mu rhythm, which would be particularly high in the central areas C3 and C4 – regions related to the sensorimotor cortex – in children with hyperactivity of mirror neurons.

In summary, while the many attempts made over decades to explain differences in cognitive intelligence, and later in emotional intelligence, through genetics have largely failed, the development of neuroscience is doing so with considerable success. We can only hope that the prejudiced view – according to which high cognitive intelligence often co-occurs with low emotional intelligence – will soon be uprooted. This will allow us to focus on solving the problems of many gifted children, problems that largely stem from a mismatch between their educational and emotional environment and their needs.

Hyperactivity of Mirror Neurons and Misophonia: A Phenomenon Common Among Gifted Individuals, But Not Only...

There are studies on the hyperactivity of mirror neurons in the sensory-emotional phenomenon known as misophonia. Misophonia is a condition characterized by strong negative emotions of anger and anxiety in response to certain everyday sounds, such as those produced by others while eating, drinking, or even breathing. The high frequency of these sounds, which result from such actions, causes misophonia to significantly disrupt the lives of those who suffer from it and their loved ones.

I define misophonia as a phenomenon rather than a disorder, primarily because it is not listed as a disorder in the DSM. However, it may be included in the next edition of this manual, as misophonia has been diagnosed for over a decade based on research criteria, such as those of Schröder and colleagues (Schröder et al., 2013). In 2022, a consensus definition was also accepted (Aazh, 2023). Whether the reason for its exclusion from the DSM is that it is a relatively new phenomenon and the intervals between DSM editions are relatively long, or whether it stems from disagreement in the scientific community about the "box" in which to frame it – whether it belongs to psychiatry, this is not the place to elaborate on the financial/insurance significance of defining an increasing number of phenomena as "disorders" with

each new edition of the DSM neurology, or the motor system – in the meantime, we do not stray from "scientific truth" if we refer to it simply as a phenomenon[3]

According to the article by Kumar and colleagues (Kumar et al., 2021), misophonia is not merely a disorder in sound processing, but rather hyper-mirroring of orofacial actions –those related to the mouth and face area, such as chewing or the clicking sounds made by others. The study found increased connectivity between the auditory/visual cortex and the ventral premotor cortex, suggesting that sound is only the medium through which the actions of others are perceived as exaggerated.

The research hypothesis of Kumar and colleagues was that the mirror neuron system underlying orofacial movements may underlie misophonia. To test this hypothesis, fMRI was used to analyze brain connectivity patterns in the resting state – when a person is not performing an active task – among 33 subjects (16 women and 17 men). In addition, sound-induced responses were examined in 42 subjects (29 of them women). The examination was conducted among people suffering from misophonia and a control group.

The results showed that, compared to the control group, the misophonia group did not exhibit a difference in auditory cortex responses to trigger sounds, but three differences were observed:

- Resting-state fMRI connectivity was stronger both between the auditory cortex and the visual cortex, and between the auditory cortex and the ventral premotor cortex[4] (responsible for orofacial movements)
- Stronger functional connectivity was observed between the auditory cortex and the orofacial motor area during the perception of sounds in general.
- Stronger activation of the orofacial motor area was observed, especially in response to trigger sounds.

These results support a model of misophonia based on hyperactivity of mirror neurons for the orofacial actions of others, in which sounds serve as the "medium" through which the actions of others are reflected in an exaggerated manner.

Thus, misophonia is not a negative reaction (abreaction) to the sounds themselves, but rather an expression of activity in parts of the motor system involved in producing these sounds. This new framework for understanding misophonia can explain behavioral and emotional responses and is of great importance for planning and implementing psychological and other interventions. This understanding can help in treating gifted individuals – for example, in response to the stereotyping often heard as "gifted people are just too sensitive," or even phrases like "stop being such a drama queen" – but not only them. For example, among artists, the phenomenon of sensory hypersensitivity is very common, as is synesthesia – the mixing of senses, a neurological phenomenon in which stimulation of one sense automatically triggers an experience in another sense, such as hearing sounds as colors, tasting words, or seeing numbers in colors. Regarding synesthesia, it is already known that unique cross-connections in the brain represent an enhanced sensory experience, not a disease. However, this is not yet the case with hypersensitivity. Therefore, understanding this phenomenon may help many children and adults, and it is especially important to explain it to professionals who treat children, some of whose difficulties in learning, social settings, and at home are caused by it.

Hyper-Empathy Among Gifted Individuals: Another 'Side Effect' of Overactivity of Mirror Neurons

Hyper-empathy refers to an exceptionally high ability – sometimes overwhelming – to sense and absorb others' emotions. This phenomenon can lead to emotional burnout, distress, and difficulty maintaining personal boundaries. Although it is not an official medical diagnosis in the DSM-5, it is characterized by "emotional contagion," in which people experience the pain or stress of others as if it were their own.

The main aspects of hyper-empathy include:

- Emotional overload caused by "absorbing" the emotions of others, leading to exhaustion and sometimes difficulty distinguishing between one's own emotions and those of others.

3 This is not the place to elaborate on the financial/insurance significance of defining an increasing number of phenomena as "disorders" with each new edition of the DSM.

4 The ventral premotor cortex is an area in the frontal lobe (part of Brodmann area 6) that is essential for the planning, learning, and execution of complex movements, with an emphasis on sensory-guided movements (visual/tactile). It is directly involved in spatial perception, eye-hand coordination, and contains nerve cells that respond to external stimuli.

- Physical symptoms, such as elevated heart rate, difficulty breathing, nausea, or muscle tension resulting from another person's distress.
- Behavioral effects, such as difficulty saying "no," a sometimes compulsive urge to solve other people's problems ("hero complex"), and disproportionately intense reactions to media content (films, videos, news, or sad stories).
- Self-neglect resulting from excessive focus on others, leaving insufficient energy to address one's own needs. This can also intensify anxiety and even lead to depression.

Already in 1983, when Howard Gardner published his book on Multiple Intelligences (Gardner, 1983), he included two types of emotional intelligence among the seven intelligences: interpersonal intelligence and intrapersonal intelligence. Interpersonal intelligence is the ability to understand other people – to identify their motives, intentions, desires, and emotions – and to interact with them effectively. Intrapersonal intelligence is the ability to understand oneself, including one's own emotions, fears, desires, and motives, and to use this awareness to manage one's life.

Heightened sensitivity, a prominent characteristic of gifted individuals, can manifest as interpersonal intelligence, intrapersonal intelligence, or a combination of both. That is, when a gifted person has overactive mirror neurons, they may be highly aware of themselves, their needs, and desires, and understand them well – but at the same time, they can not only understand others but actually feel them and identify with them deeply. This duality often makes certain behaviors among gifted individuals difficult to understand.

For example: Among girls with hyper-empathy who are perceived as very loving and surrounded by friends who seek their closeness, there is a strong need for "alone time" – a need already identified by Barbara Kerr (Kerr, 1987), and further recognized by several child and adolescence researchers specifically as a characteristic of gifted girls (e.g., Zorman & David, 2000), as a constructive domain that supports adolescent development (Larsen, 1997), or beneficial for concentration, emotional renewal, creativity, self-understanding, and preparation for social life (Galanaki, 2012). Since then, it has been recognized as essential for the self-regulation of people with hyper-empathy (see Aron et al., 2012; Bas et al., 2021; Thomas, 2024; Thomas & Nelson, 2025).

Another example is Alice Miller's famous book The Drama of the Gifted Child (200 [1996]), which discusses the "compliant child" – a pattern found not only among cognitively gifted children but especially common among them (e.g., Battmer, 2023; Neihart, 1999).

Conclusion

Hyper-empathy is not necessarily a disadvantage; it is a specific ability that can be leveraged in many areas, especially in relationships — both social and professional. For instance, the ability to understand others and identify with them, which usually appears at a young age, greatly helps in making and maintaining friendships and in gaining long-term social appreciation. This ability is extremely important in almost all professions. The myth of the "lonely gifted person" sitting at an empty table producing literary, musical, or mathematical works was debunked decades ago. Moreover, there are professions in which hyper-empathy is essential – particularly in all fields related to physical and mental health, where the ability to understand the other person, make them feel contained, empathized with, and valued is crucial for the therapist.

Nevertheless, hyper-empathy must be managed wisely: do everything possible to avoid neglecting the "self," create as much space as possible between draining tasks, and make room for enjoyable physical activity and "alone time."

For parents, teachers, and mental health professionals working with gifted individuals: It is important to understand that no child, teenager, boy, or girl chooses to have hyper-empathy. They are born with it — for better and for worse — just like eye color. It is impossible to become "less sensitive" or to "stop thinking about unpleasant things" by external command. The key concept here is self-regulation, which should be encouraged and developed. Only through proper guidance can we help the gifted person with hyper-empathy achieve the highest possible level of physical and mental well-being.

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