Social Media and the Social Brain

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All of the authors on this paper identify as women. In terms of racial identity, one author identifies as Black mixed-race, one as Asian, one as Pacific Islander and Asian, and two authors identify as White.

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Social connection is a fundamental need for human well-being and survival, and it reduces the experience of negative emotions and increases positive emotions (Lieberman & Eisenberger, 2009; Panksepp, 2004). By contrast, the lack of social connection can be detrimental and can increase negative emotions. Social media platforms offer new channels for connection (Bucher, 2015), including sharing and exchanging content, providing social affirmation, and learning about others within the network and beyond (boyd & Ellison, 2012; Henderson et al., 2013). Emerging research in neuroscience highlights some of the ways that social media use might engage brain systems that support humans' motivation and ability to connect with others (Crone & Konijn, 2018; Meshi et al., 2015; Meshi & Özdem-Mertens, 2020), and hence contribute to some of our most important emotional experiences. In this chapter, we review emerging evidence highlighting key relationships between the brain's reward-value and mentalizing systems and corresponding motivations associated with social media experiences including information sharing, receiving social approval and disapproval, and learning about the networked social world. We conclude the chapter by highlighting how adolescent development is a key period for additional study at the intersection of social media, emotional experiences, and the brain.

Neuroimaging as a Tool to Study Social and Emotional Experiences

Neuroimaging Basics

Individuals do not always have the ability or desire to objectively reflect on and explain their thoughts, emotions, and behaviors through self-report (Nisbett & Wilson, 1977). As well, direct introspection can change the process being studied (Dijksterhuis, 2004). Neuroimaging can track multiple cognitive, social and emotional processes simultaneously unfolding in participants' brains as they process information (Coronel & Falk, 2017). By making hypotheses about neural activation in brain systems tied to specific psychological processes (e.g., those involved in social media experiences and/or emotional experiences, such as reward-value and mentalizing), neuroimaging findings can expand on social science theories and complement other modes of communication science inquiry (Falk et al., 2015; Weber et al., 2018). Many of the studies reviewed in this chapter use a non-invasive neuroimaging technique called functional magnetic resonance imaging (fMRI), which measures changes in blood flow as an indirect measure of brain activity (see this book's chapter on neuroscience for more examples of using neuroimaging methods to study questions in communication).

Reward-Value and Mentalizing as Central Processes Involved in Social Media Engagement and Emotional Processes

In this chapter, we focus on two key brain systems relevant to social goals that have an impact on emotional well-being during experiences that are common on social media (i.e., sharing information, receiving affirmation or rejection from others, and learning about the social world more broadly). The subjective valuation and reward system in the brain (which we will refer to as the reward-value system for short) is activated in response to the anticipation and receipt of rewards, as well as broader subjective evaluations and judgements of positive value, including emotional gratification in response to social needs being met (Bartra et al., 2013; Schultz, 2006). As depicted in Figure 1, the reward-value system includes the ventromedial prefrontal cortex (VMPFC) and ventral striatum (VS), among other regions (Bartra et al., 2013). Critically, many of the decisions people make about when and how to engage on social media involve weighing the possible social and emotional benefits, which is supported by the reward-value system (Scholz et al., 2020).

The second brain system supports mentalizing, which is the process of understanding another person's psychological state (i.e., thinking about what another person is thinking or feeling). Also depicted in Figure 1, the mentalizing system includes the medial prefrontal cortex (MPFC), posterior superior temporal sulcus (pSTS), temporal parietal junction (TPJ), posterior cingulate cortex (PCC), and precuneus, among other regions (Frith & Frith, 1999; Krall et al., 2015; Saxe & Wexler, 2005). These brain regions are implicated in social media use because we rely heavily on our ability to mentalize when interacting with others and when, as a result, we experience social emotions (e.g., pride, shame), or emotions that relate to our social goals and relationships with others (e.g. joy, humor, and sadness; Britton et al., 2006).

In the following sections, we offer examples of how these processes could come into play during common social media experiences.

Socioemotional Processes Underlying Social Media Interactions

Sharing Information on Social Media

Many social media platforms allow users to share information with other individuals or with broader audiences (boyd & Ellison, 2012). Recent neuroscience work suggests that the brain's reward-value system uses emotional and social inputs to weigh the potential costs and benefits of sharing to arrive at a decision about what and when to share (for a review, see Scholz & Falk, 2020). For example, early fMRI research demonstrated that people were willing to forgo money when making the decision to share information about themselves with others, which suggests sharing information with others elicits positive feelings because it is inherently rewarding for the sharer (Tamir & Mitchell, 2012). Later work also showed that participants whose brains showed stronger connections between regions at the intersection of the reward-value and mentalizing systems and other parts of the brain also reported engaging in more self-disclosure on social media (Meshi et al., 2016).

Moving beyond sharing about one's self, Berger (2014) argued that people share information on social media that they consider to be self-relevant and valuable, while anticipating how others will respond to the content they share. In line with this view, thinking about sharing an article on Facebook, compared to focusing on the content of the article or thinking about reading the article, increased activation in parts of both the reward-value system (i.e., VS and VMPFC) and mentalizing system (i.e., MPFC, PC, TPJ, STS; Baek et al., 2017). Further, the degree to which viewing articles elicited activity in the reward-value and mentalizing systems across participants in the fMRI study was associated with the rate of large-scale sharing of those same articles in the population of *New York Times* readers around the world (measured using objective logs of article sharing from the *New York Times* Application Programming Interface; Scholz et al., 2017). Taken together, these studies highlight the importance of the social and emotional inputs that are processed in the reward-value system in sharing decisions at both the individual and population levels.

Processing Social Affirmation and Approval

Sharing information on social media can lead to positive feedback (e.g., likes, positive comments, social support; Barasch, 2020). Social approval is a type of reward that elicits similar brain responses to primary appetitive rewards, such as tasty foods, and secondary rewards, such as money (Bhanji & Delgado, 2014; Davey et al., 2010). The experience of being liked by others and other forms of positive feedback on social media (e.g., supportive comments in response to a shared post) can increase positive emotions (Hayes et al., 2016), help build social relationships (Ellison et al., 2011; Scissors et al., 2016), and activates brain regions involved in the reward-value system, including the VMPFC and NAcc, and the mentalizing system, including the PCC and precuneus (Davey et al., 2010).

On social media, one common way of exchanging positive feedback is through "likes" and other one-click methods for expressing approval (Sherman et al., 2018). Focus groups, interviews (Hayes et al., 2016) and behavioral experiments (Rosenthal-von der Pütten et al., 2019) converge in showing that receiving likes on social media elicits positive emotions and can also enhance interpersonal relationships and social status. Within the brain, receiving likes in a virtual chat room task increases activation in reward-value brain regions (VS), suggesting it is a rewarding experience that could elicit positive emotions (Achterberg et al., 2017; Davey et al., 2010; Gunther Moor et al., 2010; Guyer et al., 2012).

To investigate the neural correlates of giving and receiving likes, two MRI studies (one with adolescents and one with adults) prompted participants to choose whether to like an Instagram-type post (a photo with a brief caption) or go to the next post. Each post had a randomly assigned number of simulated likes that participants believed were from real participants in the study (Sherman et al., 2016, 2018). Both studies found that when participants were viewing their own posts on the simulated social media platform, their brains showed greater activation in regions involved in the reward-value system (e.g.,VS and VMPFC) when their posted photo had received many likes from their peers. Additionally, the study that only included adolescents also found neural activation in the mentalizing system, including the precuneus and left temporal pole, when the adolescents viewed photos they shared that received many likes from peers (Sherman et al., 2016). These results complement the findings from the focus group and behavioral study referenced above, which suggest receiving likes on social media is a rewarding experience that engenders positive emotions and involves thinking about social relationships.

In an extension of the mock Instagram study described above, Sherman and colleagues (2018) found that the decision to like a photo was associated with activation in the brain's reward-value system, just as receiving likes was. This is consistent with the idea that giving likes to others on social media is a positive social experience accompanied by positive emotions, which also complements evidence from focus groups and interviews (Hayes et al., 2016).

In sum, studies to date highlight consistent involvement of the brain's reward-value system in processing social affirmation and approval. This aligns both with basic science investigations showing that social approval is processed as a basic reward (Bhanji & Delgado, 2014; Davey et al., 2010) and with research in communication that highlights the positive emotions that people anticipate and receive from social media use (Ellison et al., 2011; Nabi et al., 2013).

Processing Social Media Rejection/Ostracism

Just as social approval can be a powerful reward and elicit positive emotional experiences, the lack of social approval can cause pain and negative emotional experiences. Social exclusion is a common occurrence online (Lutz & Schneider, 2020) and can lead to feeling rejected and ostracized, which is followed by negative emotions and thwarted satisfaction (Lutz & Schneider, 2020; Schneider et al., 2017).

One of the most commonly used methods to experimentally study social exclusion is through Cyberball, a virtual ball-tossing computer game where participants are included or excluded by other simulated players whom they believe are real individuals (Williams & Jarvis, 2006). In a meta-analysis of such research, Vijayakumar and colleagues (2017) found that portions of the brain's 'social pain' system (including the anterior cingulate cortex [ACC]), in addition to parts of the mentalizing system, such as the MPFC, were reliably activated during instances of social exclusion. Further, results from a recent study using Cyberball found habitual Facebook users showed higher levels of neural activity in the mentalizing system (i.e., MPFC, bilateral TPJ, and precuneus) during social exclusion than infrequent Facebook users did, indicating that habitual users may engage more efforts in mentalizing (e.g., thinking about the intentions of the other players) when being excluded (Pei et al., 2020). This study also found that habitual Facebook users experienced lower levels of psychological distress after social exclusion, which suggests that frequently using a platform that provides a stable channel for social connection, like Facebook, may buffer against the negative effects of social exclusion.

Even more closely paralleling a social media environment, the Social Media Ostracism paradigm simulates social exclusion with feedback on social media profiles (Wolf et al., 2015; see http://smpo.github.io/socialmedia/ for a demo version). Using this paradigm, exclusion on social media led to lower self-reported levels of belongingness, self-esteem, and meaningful existence (Schneider et al., 2017). In this way, just as receiving "likes" can be affirming, the lack of social approval on social media can lead to negative emotions.

In a neuroimaging study that used a similar paradigm, participants received equal proportions of positive, negative, or neutral feedback in response to their social media profile (Achterberg et al., 2016). Receiving positive or negative feedback (vs. neutral feedback) was associated with increased brain activity in regions associated with mentalizing (i.e., MPFC) which was likely a response to interpreting the motivations of people who provided the feedback. Unlike the social exclusion studies described above, participants received an equal number of likes ("thumbs up") and dislikes ("thumbs down"), making both forms of social feedback salient, which may explain why there was no significant differentiation between the neural response to negative and positive feedback.

Taken together, these studies highlight the involvement of the mentalizing system, in addition to affective "social pain" regions, in processing and responding to social exclusion. Future research is needed to better understand the neural response and negative emotions associated with rejection and social exclusion on social media, including the extent to which the absence of social approval, the active experience of rejection, and other experiences that produce negative emotional experiences online share common neural underpinnings.

The Brain and Social Networks

Social networks are intrinsic to social media, as individuals are connected through affordances, such as friending, messaging, liking and following. As social connection is a fundamental human need (Lieberman & Eisenberger, 2009; Panksepp, 2004), these affordances can be integral in fostering well-being (Bayer et al., 2020). When navigating any social environment, individuals must learn about the interconnections between other people (Rainie & Wellman, 2012), which can help increase the chances of developing positive relationships. If successful, this can lead to more of the positive emotions associated with fostering relationships with others (e.g., the joy of strengthening a friendship by bonding with the friend's sibling) and avoidance of the negative emotions that result from severing meaningful social ties (e.g., the pain of losing a friend after speaking ill of someone who, unbeknownst to you, was the friend's sibling). Learning about social networks is particularly salient and made easier to quantify with digital traces on social media (González-Bailón, 2017).

Neural Processes Associated with Learning about the Structure and Function of Social Networks

Recent studies have investigated how the brain may support the (often automatic) perception and learning of key social network characteristics, such as size, structure, and socially and emotionally relevant attributes of network members (e.g., who can provide empathy and social support [Morelli et al., 2018] or who is well liked [Zerubavel et al., 2015]). For example, viewing photos of the faces of social network members who were more popular was associated with greater activation of the reward-value and mentalizing systems (Zerubavel et al., 2015), highlighting the idea that the brain automatically tracks the potential emotional value of different network ties. A second study found that brain activity in the reward-value and mentalizing systems also automatically tracked social network members who were frequently nominated by others as providing emotional support and empathy (Morelli et al., 2018). In line with this reasoning, Parkinson and colleagues (2017) found that the brain spontaneously encodes other social information, which could guide individuals when anticipating the emotional gratification of interacting with someone online. Taken together, the findings from these studies indicate that the reward-value and mentalizing systems are involved in tracking specific social and emotionally-relevant attributes (such as popularity, tendency to empathize with and provide support to others). In turn, this information may guide individuals to allocate attention to relationships with people who are likely to support specific social and emotional needs. These processes may also support mentalizing, which could help individuals form social relationships and improve well-being.

Social Network Positions Moderate Neural Processes in Social Interaction

In addition to investigating how key neural systems may support the perception, learning, development, and maintaining of social networks that form the basis of various social and emotional experiences that we encounter on a daily basis, there is growing research interest in understanding how the social network positions of individuals may modulate their neural activity during social interactions on and off line.

First, a relatively extensive body of research has examined the link between the brain and the size of people's social networks (for a review, see Noonan et al., 2018). Here, the size of the amygdala, a brain region that plays an important role in emotional salience and social processing, is positively correlated with the social network size offline (i.e., the number of people with whom one regularly interacts; Bickart et al., 2011) and in online social networks (Kanai et al., 2012). Further reinforcing this link, a study measured the sizes of both offline and Facebook social networks of forty female participants (Von Der Heide et al., 2014). Although offline and Facebook networks diverged greatly in sizes within the sample (mean size of offline social network = 41.29, mean size of Facebook social network = 477.61), in both cases larger social networks were significantly associated with larger amygdala size. One possibility for the larger amygdala is that people with larger online social networks tend to be faced with more complex social and emotional information due to the complexity of the social networks in which they are embedded. Those with larger networks also showed more amygdala activation when viewing both familiar and unfamiliar faces. Thus, individuals with larger online social networks may find social stimuli (such as faces) more emotionally salient, and spend more time building and maintaining social networks. Or conversely, being part of larger social networks may condition individuals with heightened saliency for emotional and social stimuli.

Moving beyond the sheer size of a person's social network, the structure of social networks also influences neural activity during social media experiences such as information sharing, acceptance and rejection, and social learning. For example, being an information broker in a social network (i.e., being connected to otherwise disconnected members, thus influencing whether [and which] information is passed between groups), was associated with stronger activation of brain regions involved in mentalizing when sharing recommendations for mobile apps (O'Donnell et al., 2017). This may occur if brokers anticipate the mental and emotional states of different groups and expend greater effort thinking about how to best present information for each group. Further, the interconnectedness of participants' online social networks relates to how the brain responds to experiences that elicit negative emotions, like social exclusion. People with more tight-knit, interconnected networks on Facebook had higher levels of neural activity in brain regions associated with social pain during social exclusion (Bayer et al., 2018), suggesting that being embedded in a close-knit social network may heighten the feeling of pain or other negative emotions (e.g., worry) in response to social exclusion. For example, the emotional costs of being left out by one person in the group could lead to concerns that the entire tight-knit friend group would follow suit. It may also be the case that individuals with higher neural sensitivity to social exclusion may gravitate to more close-knit social environments, offering a social buffer and minimizing the negative emotions brought on by isolation. In contrast, individuals with less dense Facebook social networks showed greater functional connectivity between regions in the mentalizing network during social exclusion (Schmälzle et al., 2017). It is possible that individuals who are part of less tight-knit social networks may process the experience of exclusion differently, which may change the emotional response to exclusion.

In sum, evidence from psychological and neuroscientific studies suggest that the brain's mentalizing and reward-value networks play a role in the perception, development, and maintenance of offline and online social networks, as well as making sense of and anticipating emotional experiences that occur on networked social media.

Future Directions: Developmental Changes During Adolescence

Although reward-value and mentalizing systems are key to several social media experiences across the lifespan, adolescence is a particularly important period in the development of these brain systems. As such, we focus the remainder of the chapter on adolescent development as a key period for future study on the intersection of the brain and social and emotional experiences on social media (Crone & Konijn, 2018).

Adolescence is a developmental period defined as a time between childhood and adulthood that begins at the onset of puberty. During adolescence, navigating relationships and peer feedback, including deciding what information to share about oneself, and the potential for social acceptance and rejection, become especially salient (Somerville, 2013). Most of the current generation of adolescents are digital natives (i.e., do not remember a time before the internet; Jones et al., 2010). Adolescents check social media multiple times a day (Common Sense Media, 2018), and 71% of adolescents report using multiple social media platforms, including platforms not widely used by other age groups (e.g., snapchat; Lenhart 2015).

Adolescents report that social media use leads to positive outcomes, such as receiving social support, feeling included, and fostering social connection with a diverse group of people (Anderson & Jiang, 2018). Many adolescents also recognize that social media can have negative effects and report feeling overwhelmed by the pressure to only share things that reflect positively on themselves and that will get many likes and comments (Anderson & Jiang, 2018). Given that many adolescents participate in multiple social media platforms and spend several hours a day using social media (Rideout & Robb, 2015), it is important to consider how social media use might impact and be impacted by brain processes for adolescents and what kind of social media platforms might most effectively benefit adolescents' well-being.

According to neurodevelopmental theories (i.e., dual-systems model, imbalance model [Casey et al., 2008; Steinberg, 2010]), adolescents' actions may be more emotionally driven and have heightened sensitivity to rewards compared to adults. This is, in part, because affective brain regions, including regions in the reward-value system, develop relatively more quickly, prior to cognitive control brain systems maturing. Adolescents have reported experiencing stronger emotions relative to adults in response to social experiences. In parallel, brain activity in the VS, a key region in the reward-value system, in response to rewards is heightened during adolescence relative to childhood and adulthood (Pfeifer & Berkman, 2018; Schreuders et al., 2018; Telzer et al., 2013). Adolescents experience more pleasure after basic rewards like winning a coin toss (Schreuders et al., 2018) and consider a more diverse set of inputs as highly rewarding, like stimuli that relate to identity development (i.e., an invitation to a party with like-minded peers even if it is the night before an important exam; Pfeifer & Berkman, 2018). This suggests that there are differences across development in the motivation to receive reward, which may impact the way adolescents use social media to seek social rewards. These differences may make the socioemotional experience of social media use different for adolescents at different stages of development (Sherman et al., 2018). For example, the positive emotions tied to reciprocal relationships increase over the course of adolescence, and the reward associated with receiving positive feedback peaks during late adolescence (Altikulaç et al., 2019).

Likewise, developmental changes to the mentalizing system may have an effect on the socioemotional experience of social media use. In typically developing children, basic mentalizing tasks are correctly solved by the time children reach the age of 4 (Saxe et al., 2004), but mentalizing ability continues to increase across adolescence into early adulthood (Dumontheil et al., 2010). These cognitive changes are reflected in results from fMRI studies, which have shown differences in how children, adolescents, and adults engage the mentalizing system during cognitive tasks (Blakemore & Mills, 2014). Social media use may offer opportunities to practice and develop some kinds of mental state inference (e.g., learning the structure of people's online social relationships; Lenhart, 2015), but may also provide less opportunity along other dimensions (e.g., knowing which of the relationships involve deeper connections, making use of the combination of verbal and non-verbal cues that occur in face-to-face interaction).

Yet, much is still unknown about exactly how developmental changes in these brain systems might interact with social media use (e.g., different affordances of social media platforms, frequency of engagement, or social network positions) to affect adolescent socioemotional development and well-being. Prior research has shown adolescents engaged the brain's reward-value and mentalizing systems when sharing information about themselves, but they were less likely to share intimate information with others than older groups (Vijayakumar et al., 2019). This suggests that like adults, adolescents find sharing rewarding, but they also use more cognitive resources to consider the social risk of sharing. This finding is consistent with the recent trend among adolescents to have both a public Instagram account and a private "Finsta" (shortened term for "fake Instagram") account that is only shared with one's very close friends (McGregor & Li, 2019). These "fake" accounts may provide teens with a less risky platform to share the less idealized (and, arguably, more accurate) depictions of themselves.

More broadly, there is much to be learned about how adolescents' social and emotional experiences on social media are processed in the brain, and how those experiences help build meaningful social connections. For example, neuroimaging research elucidating how adolescents process social risks could help inform the design of social media platforms that encourage positive risk taking (i.e., risks that support key developmental goals, like understanding oneself and others), while mitigating negative social and emotional consequences. Related to our Finsta example, disentangling the neural processes that track audience size and closeness when adolescents post about themselves on social media platforms will help researchers learn more about how different platform affordances contribute to the perceived risk of self-disclosure in adolescents, and the development of mentalizing skills.

Further research is also needed to inform how identity interacts with the processes described in this chapter because adolescents with different identities (e.g., related to race, gender, sexual orientation, and other important personal attributes) may have different experiences and needs on social media. Identity exploration during adolescence is integral to emotional well-being, and social media can give adolescents the opportunity to explore their identity. The ability to connect to like-others on identity-based social forums (e.g., subreddits) might be especially important for the emotional well-being of adolescents with marginalized identities, because they may lack that type of connection in person. Research in this domain can inform social media interventions that foster meaningful connections and allow adolescents to take more social risks with a more diverse group of people.

Adolescents today meet developmental milestones like managing relationships, identity exploration, and developing autonomy from parents, in part, via social media. As social media plays an increasingly important role in adolescents' lives, it is critical to understand whether or in what ways different forms and quantities of social media engagement might shape brain development during adolescence, and how baseline differences in these brain systems might predispose adolescents to different amounts or types of social media use (Crone & Konijn, 2018; Mills et al., 2014; Valkenburg & Piotrowski, 2017; Wartella et al., 2016; Wilmer et al., 2017).

Preliminary evidence highlights that there are neural differences between adolescents who engage with social media differently. One neuroimaging study found that adolescents who used their smartphone, which includes social and other new media, more often had stronger connectivity between the VS and VMPFC, two key regions in the reward-value system (Wilmer et al., 2019). The same study also found adolescents who used their smartphone less had stronger connectivity between the VS and dorsolateral prefrontal cortex (dlPFC) - a key brain region related to cognitive control, memory and attention. Although this is not direct evidence that social media use causes changes to these key brain systems, these results suggest adolescents who spend more time on their smartphone may process rewards differently than adolescents who use it less, such that they have a higher tendency to choose short term rewards over long-term goals. Other research mentioned in this chapter (Sherman et al., 2016; Vijayakumar et al., 2019) also suggests that adolescences who spend more time on social media are likely to process social acceptance and rejection differently, which reflects potential avenues where social media use could shape brain development. However, the causal direction of those results is unknown. Future studies with longitudinal and/or experimental designs that examine differences in time spent on social media, types of social media platforms used with varying affordances, and levels of engagement on those social media platforms can help elucidate whether, and how social media use could shape the still-developing adolescent brain.

In addition to the impact of social media on brain development, whether developmental changes across adolescence may impact how adolescents use social media is also an open question. There is substantial individual variability in the social media content that adolescents engage with (Ram et al., 2020) as well as the social and emotional support they receive within their social networks (Bayer at al., 2020). These types of variability are coupled with differential reactivity of key brain systems to acceptance, rejection, and peer influence, and likely shape adolescents' social media experiences (Crone & Konijn, 2018). Future research on social media and the brain is needed that focuses on adolescent social media use and the important socioemotional developmental changes that occur during adolescence. This will help reveal how the experiences we described above (sharing, affirmation and rejection, learning about the structure and function of social networks) and others may be impacted by the neural structures supporting these behaviors. For example, causal interventions aimed at adolescent wellbeing on social media, coupled with neuroimaging studies that measure neural activation in regions associated with socioemotional processes during positive (e.g., receiving likes after sharing personal information) and negative social media experiences (e.g., being ostracized) can inform how brain structure and function can amplify positive effects of social media and mitigate or intervene to reduce negative effects. Indeed, the tremendous plasticity and change that occurs over the course of adolescence may offer a window into the neural and psychological processes that make people more broadly vulnerable and resilient to negative effects, and receptive to positive opportunities on social media.

Conclusion

In conclusion, using social media can foster social connection, which promotes positive emotional experiences and well-being, and is necessary for human survival. The interdisciplinary research we review combining evidence from communication, psychology, and neuroscience suggests that the brain's reward-value and mentalizing systems are relevant to many social media experiences, including sharing and responding to positive and negative social feedback, as well as broader social media uses, including learning about the structure and function of social networks. By continuing to study brain-behavior relationships in the context of social media, the field will learn more about the social and emotional experiences of social media, and the basic science of social connection. Additionally, more research with a focus on the interaction between neural development during adolescence and adolescent social media use will further understanding of what types of social media can improve well-being during this period of psychological, neural, and social development.

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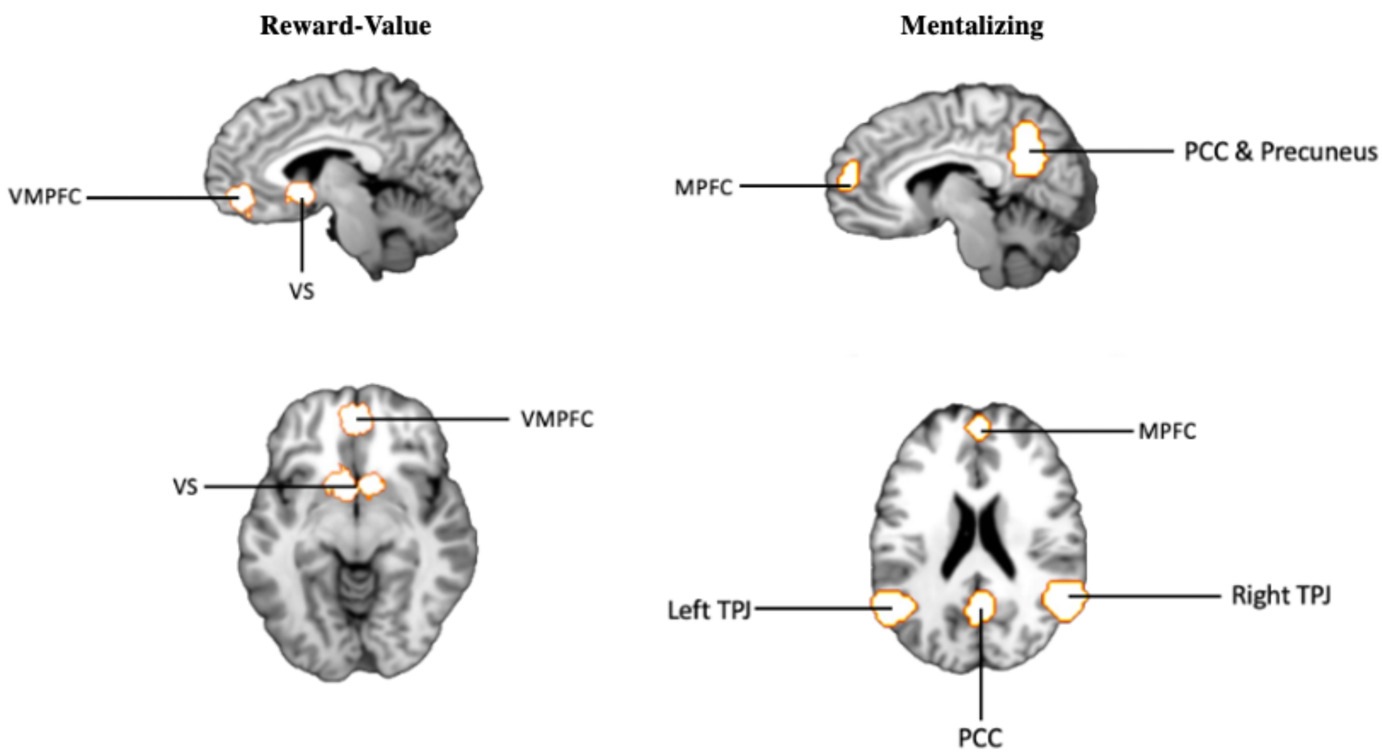
Figure 1

Reward-Value and Mentalizing Brain Regions



Note. The reward-value and mentalizing brain regions are highlighted in white.

Reward-value: ventromedial prefrontal cortex (VMPFC), and ventral striatum (VS), which include the nucleus accumbens, NAcc, and ventral tegmental area, VTA), among other regions.

Mentalizing: medial prefrontal cortex (MPFC), posterior superior temporal sulcus (pSTS), temporal parietal junction (TPJ), posterior cingulate cortex (PCC), and precuneus, among other regions.