Exploring the self in adolescent depression: neural mechanisms underlying social evaluations and self-views from a parent-adolescent perspective

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GENERAL INTRODUCTION

Adolescence – derived from the Latin *adolescere*, 'to grow into maturity' – is an essential developmental period, characterized by biological, psychological, and social changes (Sawyer et al., 2018). The adolescent period is therefore typically seen as a window full of opportunities, but also vulnerabilities (Fuhrmann et al., 2015), as many psychiatric conditions, such as depression, first emerge (Costello et al., 2011; Paus et al., 2008). Adolescent depression is a major mental health issue due to its high prevalence (Ormel et al., 2015), substantial burden of illness (World Health Organization, 2019), and high recurrence rate (Curry et al., 2011). Moreover, adolescent-onset depression is associated with myriad negative psychosocial outcomes across the lifespan, such as reduced educational attainment and unemployment (Clayborne et al., 2019; Johnson et al., 2018). Therefore, elucidating neural and psychological mechanisms underlying disturbances that adolescents with depression experience, such as a negative self-image, seems to be crucial to find key targets to treat, or even prevent adolescent depression.

Adolescence also represents a sensitive period for caregiving, in which the main task of parents is to assist adolescents in their transition from a dependent child to an independent adult (Crone and Dahl, 2012; Steinberg and Silk, 2002). This emerging independency is accompanied by increased self-consciousness, greater orientation toward peers and away from one's parents, and hypersensitivity to social evaluation (Schriber & Guyer, 2016). Although adolescents usually strive for autonomy to individuate themselves from their parents, adolescents still seem to greatly rely on their parents for their emotional well-being (Grotevant and Cooper, 1985; McLean, 2005; Welborn et al., 2016). For instance, both parental praise and criticism can form adolescents' self-concept and self-esteem in crucial ways (Brummelman & Thomaes, 2017; Harter, 2015; Jacquez et al., 2004), with long-lasting effects (Koepke & Denissen, 2012). Furthermore, for parents, receiving feedback about their child can also be very impactful. Moreover, how parents in turn process this feedback may have considerable consequences for interpersonal dynamics of parent *and* child, and on the long run, the child's self-esteem (Lee et al., 2017). Hitherto, however, neuroimaging studies tended to focus on neural processing in response to *peer* feedback (see e.g. Burnett et al., 2011; Güroğlu & Veenstra, 2021; Vijayakumar et al., 2017), despite emerging evidence that parents seem to have a stronger influence on adolescent self-concept development than peers (Branje et al., 2021). How praise and criticism about the adolescent is processed by adolescents *and* their parents in terms of affective and neural responses is understudied.

The self develops across the lifespan and adolescence seems to be a crucial period for self-concept development (Rapee et al., 2019). During early childhood, self-views are unrealistically positive. As cognitive abilities develop, children start with basing their self-evaluations on external feedback and social interactions, resulting in more balanced and accurate self-views. During adolescence, self-views become even more complex, due to the emerging capacity to think about the self, others, and one's future in a more abstract

way. These psychological changes develop in tandem with acquiring new social roles in rapidly changing interpersonal contexts. For instance, adolescents need to develop their own identity separate from their parents (Harter & Leahy, 2001; Orth et al., 2018; Robins & Trzesniewski, 2005; Sebastian et al., 2008). Moreover, neural substrates involved in self-related processing continue to develop during adolescence (Mills et al., 2016; Tamnes et al., 2017), further underlining the relevance of this period for self-concept development.

The representation of the self is severely affected in individuals with depression, coloring all aspects of a person's experience of oneself negatively, also in interactions with others (Davey & Harrison, 2022). For instance, depression is often characterized by negative self-perceptions and low self-esteem (Rappaport & Barch, 2020; Sowislo & Orth, 2013). An important question is how disturbances in the self in adolescents with depression are related to interactions with their parents, for instance when receiving praise and criticism. Additionally, it is important to investigate how the self is represented in *positive* scenarios, for instance, when recollecting positive autobiographical memories. Autobiographical memories are central to one's identity, and evidence suggests that recollecting positive memories can be a strategy for mood-repair and self-esteem enhancement (Harris et al., 2014; Harter & Leahy, 2001). Therefore, positive memory recollection has clinical potential to target negative self-perceptions, low self-esteem, and low mood in adolescent depression.

The **first aim** of this dissertation was to examine neural sensitivity to social feedback in both parents and adolescents, and how this sensitivity is modulated by self-views. Parents commonly receive social feedback about their child during conversations with others, such as teachers, sport coaches, clinicians, friends, or family members (e.g., Pillet-Shore, 2012, 2015). Given their genetic ties and large effort of investment, parents may show heightened responses to this form of 'vicarious social feedback', which can shape interpersonal dynamics of parent and child, and even how *adolescents* view themselves. In turn, how adolescents process *parental* feedback may be dependent on both the parent-child relationship and their own mood. Therefore, it is essential to have a general understanding of how both parents and adolescents react to social feedback about the adolescent child in terms of affective and neural responses. Furthermore, to inform intervention strategies, it is critical to understand whether self-views and parental behaviors influence affective and neural responses to social feedback. The **second aim** of this dissertation was to examine potential alterations within (neural) mechanisms supporting self-processing in adolescent depression, e.g., sensitivity to social evaluation and disturbed self-views, and bi-directional influences of parent-adolescent interactions. Therefore, the second part of this dissertation focusses on how adolescents with depression react to social feedback from their parent, whether their (negative) self-views play a role in their responses, and to what extent reliving positive autobiographical memories, i.e., reconstructing the positive self, may impact activity in neural networks and/or promote well-being in adolescent depression. See Figure 1 for a

graphical overview of the chapters in this dissertation.

The remainder of this chapter sketches a theoretical framework for this dissertation. First, a theoretical model of associations between the self, social interactions, and autobiographical memory will be outlined, and more specifically within the parent-adolescent context. Next, key findings on neural processes involved in social interactions, the self, and autobiographical memories will be summarized. Subsequently, it will be explained how adolescent depression is currently conceptualized, including the low self-esteem and other negativity biases as well as neural networks affected in adolescent depression. Finally, the RE-PAIR study, where all findings from this dissertation are based on, will briefly be introduced and the specific dissertation aims will be summarized at the end of this chapter.

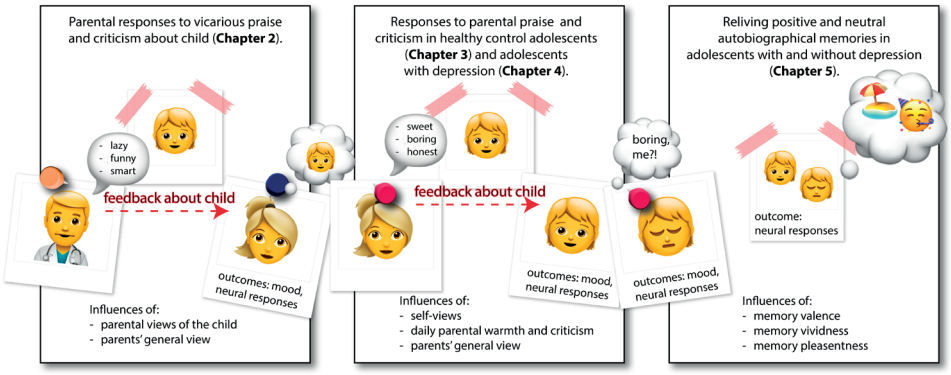

Figure 1. Graphical overview of chapters in dissertation.

THE SELF, SOCIAL INTERACTIONS, AND AUTOBIOGRAPHICAL MEMORY

Human beings are wired to be social, which is crucial for our health and survival (Snyder-Mackler et al., 2020). Starting already early in development, we acquire sophisticated skills via social interactions, primarily with our parents. That is, we imitate and learn from others' behaviors, engage in joint attention, and try to understand the mental states of others, i.e., mentalizing. In this way, we develop shared views of the world, of others, and of ourselves, which helps us navigating the complex social world (Carpendale & Lewis, 2004). People are shaped by social interactions and vice versa. Therefore, social interactions are invaluable in our everyday life, and inextricably connected with how we view ourselves (Markus & Wurf, 1987).

The self can be conceptualized as a dynamic structure mediating both intrapersonal (e.g., information processing, affect, memories) and interpersonal processes (e.g., social perception, interaction strategies, reactions to feedback) (Markus & Wurf, 1987). Two main aspects of the self are: i) the *experiential self*, i.e., the self we experience in the present

moment, being physically imbedded (without need for cognitive elaboration), and ii) the *narrative self* (or *autobiographical self*), being composed of the self, and self-other representations with a continuity over time, connecting past experiences and sense of self with present and future selves (Davey & Harrison, 2022). Although these two pivotal aspects are different, they are not distinct: we usually experience the self as one entity. However, due to its dynamic nature, the self can largely vary across contexts (e.g., at home, at work), life phases, and mood states, including a depressed state.

The narrative self fits with classical psychological theories such as Cooley's looking-glass self (Cooley, 1902) and 'Sociometer' theory (Leary et al., 1995), proposing that how others perceive us and what they think of us, shape how we perceive and feel about ourselves and our relationships. The self is thus informed by interactions with others, and vice versa. The self is further informed by autobiographical memory, which refers to representations of one's personal history that integrate the current self with past experiences, including their interpretation and evaluation. Autobiographical memories therefore define who we are, help us to relate to others, and guide current and future behaviors (Fivush et al., 2011). In turn, current self-views may determine which autobiographical memories are most, and least, accessible (Conway & Pleydell-Pearce, 2000). Because of these characteristics, recollecting *positive* autobiographical memories could have potential for clinical implications for individuals with low self-esteem and/or low mood, such as patients with depression. Indeed, recently, novel autobiographical memory-based interventions were developed to strengthen the self, and/or create a more positive self, for instance by making positive autobiographical memories more accessible, which can have a positive impact on mood and well-being (Dalgleish & Werner-Seidler, 2014; Hitchcock et al., 2017; E. A. Holmes et al., 2016; Korrelboom et al., 2012; Pile et al., 2020).

These classical theories implicate that social feedback elicits a certain emotional response, which in turn can adapt our own feelings and views of the self and others. Indeed, social feedback can have a profound impact on mood and well-being (van Schie et al., 2018; Vandellen et al., 2011), especially during adolescence (Rodman et al., 2017; Somerville, 2013). Receiving positive social feedback results in positive mood and high self-esteem, whereas negative feedback is related to more negative feelings. However, how exactly people react to social feedback may largely depend on pre-existing self-views. That is, feedback that is consistent with one's own self-views, either positive or negative, can provide a sense of stability and predictability of the self, and therefore is processed more easily and experienced as more pleasant (Stinson et al., 2010; Swann Jr et al., 2007; van Schie et al., 2018). Along similar lines, feedback *inconsistent* with self-views, even positive, may result in more negative feelings.

Fostering a stable sense of self in adolescence is considered an important task, not only for adolescents, but also for their *parents*. That is, both negative and positive feedback *from parents* play a pivotal role in self-concept development (Brummelman & Thomaes, 2017; Harter, 2015; Jacquez et al., 2004). Adolescents' self-concept development usually fares best when their parents acknowledge the developing autonomy, but at the same time stay connected with their child (Steinberg & Silk, 2002). In a similar vein, when parents witness their adolescent children being evaluated, they may not only empathize with their children, but may also feel personally judged (Thai et al., 2019). This may be related to the fact that parental self-views can also include views of one's child, being part of their self (Hermans, 2008). As a result, parents might be affected by social feedback about their child through vicariously experiencing it as if feedback was directed at themselves. In turn, these experiences may have consequences for parental reactions toward the feedback provider, but also toward the child, such as criticizing or (over)praising the child, impacting interpersonal dynamics, and ultimately, may impact how *adolescents* view themselves. Insight into these responses may be useful for targeting awareness of parents' own perceptions and reactions to feedback about their child. Therefore, investigating how both parents and adolescents respond to feedback about the adolescent child, and how views of the child impact these responses, are key objectives of this dissertation (**Chapter 2, 3**).

THE SOCIAL BRAIN AND THE SELF

Given that social interactions are indispensable in our daily life and crucial for our self-concept and well-being, it is important to understand underlying neural mechanisms involved when the self is the object of social evaluation, particularly within the parent-adolescent context. A vast amount of functional MRI (fMRI) studies has shown remarkable consistency in identifying regions of the 'social brain'. The social brain refers to a network of brain regions involved in social cognition, i.e., recognizing, understanding, and interpreting social cues from others – their intentions, feelings, and thoughts – in relation to the self. Regions of the social brain include the medial prefrontal cortex (mPFC), temporoparietal junction (TPJ), posterior superior temporal sulcus (pSTS), posterior cingulate cortex (PCC), precuneus, and temporal poles (Adolphs, 2009; Andrews et al., 2021; Blakemore, 2008; Kennedy & Adolphs, 2012; Van Overwalle, 2009). This network is also referred to as the 'mentalizing network' (Frith & Frith, 2006; Schurz et al., 2014). Another network relevant for social interactions is the salience network, including anterior cingulate cortex (ACC), anterior insula (AI), and amygdala, which is important for detecting and responding to salient (social) stimuli, such as fearful faces or pain perception (Menon & Uddin, 2010).

Interestingly, social interactions, the self, and autobiographical memories appear to be inherently intertwined, not only on a conceptual level (as outlined above), but also at the level of the brain, with overlapping neural networks involved in both social- and self-related, as well as autobiographical memory processing, see Figure 2. The mentalizing network, for example,

highly overlaps with the default mode network, including mPFC, PCC, precuneus, and TPJ, involved in *self*-related processing. To be specific, the default mode network is consistently activated during internal processes and deactivated when selective attention to external stimuli is needed (Buckner et al., 2008; Buckner & DiNicola, 2019; Davey et al., 2016; Mars et al., 2012; Spreng et al., 2009). Similarly, autobiographical memory tasks activate brain regions that closely resemble the default mode network. This autobiographical memory network encompasses mPFC, ACC, hippocampus, retrosplenial cortex/ PCC, precuneus, ventrolateral PFC, temporal poles, TPJ, and the cerebellum (Andrews-Hanna et al., 2014; Spreng et al., 2009; Svoboda et al., 2006; Tailby et al., 2017). Thinking about one's own and others' mental state seem to rely on similar cognitive processes, in the sense that they both require to focus on internal processes rather than focusing on the outside world (Buckner & DiNicola, 2019).

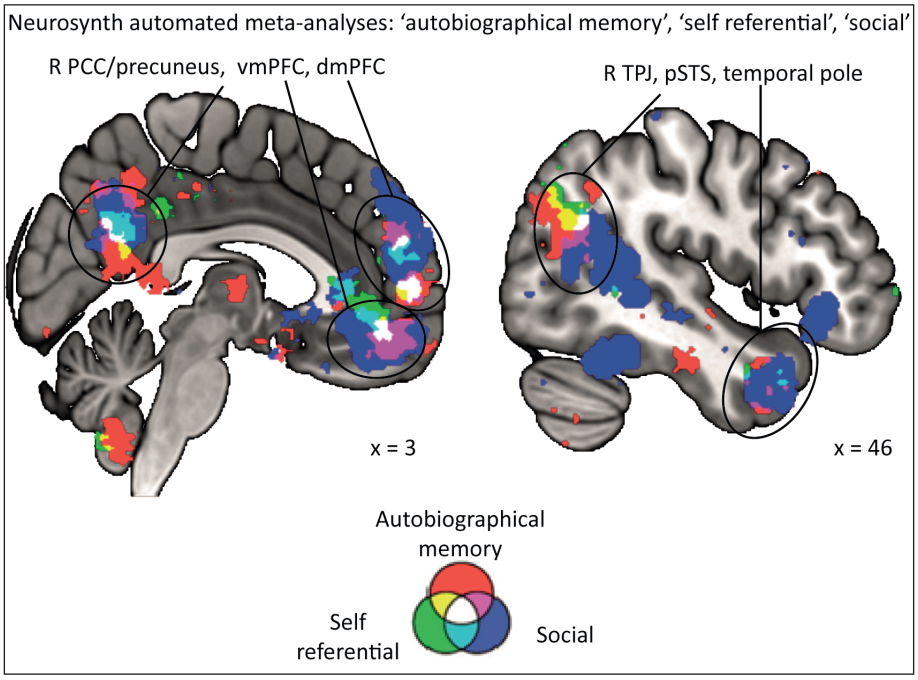

Figure 2. Neurosynth automated meta-analysis association maps using the terms 'autobiographical memory' (84 studies), 'self referential' (166 studies), and 'social' (1302 studies) illustrating the strong overlap between neural networks involved in both social- and self-related, as well as autobiographical memory processing.

In neuroimaging studies investigating social *evaluation*, social acceptance feedback from *strangers* has been consistently found to activate ventral striatum (VS), a key region in reward and pleasure processing, and the ventral mPFC (vmPFC), typically associated with

social value computation (Davey et al., 2010; Gunther Moor et al., 2010; Izuma et al., 2008; Kawamichi et al., 2018; Korn et al., 2012; Morelli et al., 2015; Muscatell et al., 2016; Schindler et al., 2019; Will et al., 2017). Social rejection feedback is associated with increased activation in ACC and AI, key regions in the salience network (Cacioppo et al., 2013; Eisenberger et al., 2011; Fritz et al., 2020; Kawamichi et al., 2018; Muscatell et al., 2016; Rotge et al., 2015; Schindler et al., 2019; van Schie et al., 2018; Will et al., 2016). However, there is emerging evidence that ACC and AI also respond to acceptance feedback, suggesting that these regions process saliency of social evaluation, independent of valence (Achterberg et al., 2016; Dalgleish et al., 2017; van Schie et al., 2018). Finally, both positive and negative social feedback elicits activity in brain regions important for mentalizing, including dorsal mPFC (dmPFC), PCC, precuneus, and TPJ (Kawamichi et al., 2018; Molenberghs et al., 2016; Muscatell et al., 2016; Schurz et al., 2014; Van Overwalle, 2009; van Schie et al., 2018), see Figure 3. Given the significance of parents for self-concept development during adolescence, it is crucial to investigate underlying neural mechanisms related to social feedback processing specifically within the parent-adolescent context. Therefore, investigating how *parents* process positive and negative feedback about their adolescent child, i.e., *vicarious* feedback (**Chapter 2**), and how adolescents process similar *parental* feedback (**Chapter 3**) will be key objectives of the current dissertation.

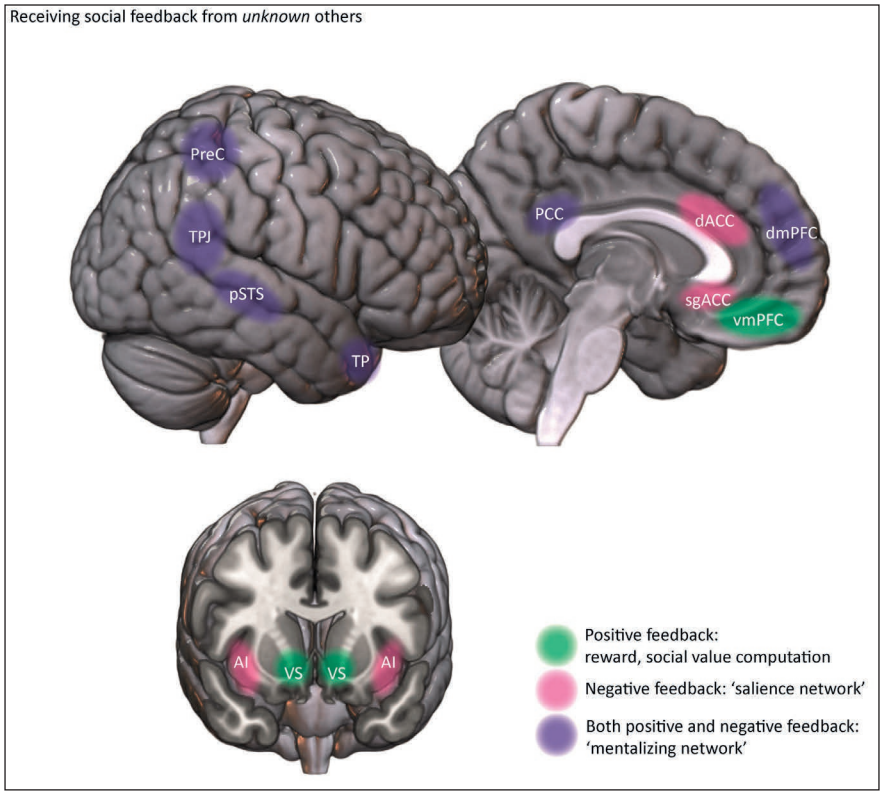

Figure 3. Neural networks involved in social feedback processing. Prior social feedback studies involving feedback from *unknown* others demonstrated that positive feedback elicits activity in ventral striatum (VS) and ventromedial prefrontal cortex (vmPFC; green) involved in **reward** and **social value computation**, whereas negative feedback elicits activity in anterior cingulate cortex (ACC) and anterior insula (AI; magenta), involved in **social saliency**. Both positive and negative feedback elicits activity in the '**mentalizing network**' encompassing (dorso)medial prefrontal cortex (dMPFC), posterior cingulate cortex (PCC), precuneus (PreC), temporoparietal junction (TPJ), posterior superior temporal sulcus (pSTS), and temporal poles (TP). This mentalizing network substantially overlaps with both the **autobiographical memory network** and the **default mode network**, involved in **self-related processing**.

ADOLESCENT DEPRESSION

Adolescent depression is primarily characterized by symptoms reflecting affect and drive, i.e., a depressed or irritable mood, loss of interest or pleasure in almost all activities (anhedonia), and reduced motivation or low energy. Particularly in adolescents with depression, increased irritability and fluctuating mood can be observed. Other symptoms reflect cognitive manifestations (i.e., self-criticism, such as feelings of worthlessness or excessive inappropriate guilt, concentration difficulties, and suicidal thoughts) or basic life processes (i.e., sleep and appetite disturbances, and psychomotor changes) (American Psychiatric Association, 2013). Given that a person meets the criteria for a depression diagnosis when having at least five of these symptoms (of which at least one core symptom: depressed/irritable mood or anhedonia, being present most of the day, nearly every day, for at least two weeks), many combinations are possible, with different severity levels and longitudinal trajectories (Davey & Harrison, 2022; Herrman et al., 2022). It could even be that two individuals meet criteria for a depression diagnosis, without sharing any symptoms (Fried, 2017). Moreover, comorbidities, such as anxiety disorders, are common in adolescent depression (Avenevoli et al., 2015).

Depression is found to result from interactions between genetic, (neuro)biological, environmental, social, and developmental vulnerabilities, as well as resilience factors, being unique for each individual (Herrman et al., 2022). The caregiving environment, inextricably linked with the parent-child bond, has been suggested to be one of the most influential factors. Prior meta-analyses on observational and self-report studies have shown that certain parental behaviors towards their child, such as a lack of warmth, psychological control, emotional maltreatment, and overprotection, are risk factors for depression; both during adolescence (Pinquart, 2017; Yap et al., 2014) and later in life (Infurna et al., 2016). However, little is known about how adolescents with depression *react* to (mal)adaptive parental behaviors. That is, the way adolescents perceive their parents' behaviors and the interactions with them may be colored by the negative self-views and attentional and memory biases that are typical for depression, resulting in bi-directional influences. Therefore, elucidating how adolescents with depression *process* interactions with their parents in the brain, may be a step forward in unravelling mechanisms involved in the onset and maintenance of adolescent depression.

AFFECTIVE RESPONSES IN ADOLESCENT DEPRESSION

Individuals with depression show *potentiated* affective responses to negative stimuli, such as threatening faces, as well as *blunted* affective responses to positive stimuli, such as anticipating or receiving rewards (Rappaport & Barch, 2020). However, evidence from a meta-analysis of emotional reactivity in depression suggests that individuals with depression show dampened emotional reactivity to *all* types of emotional stimuli, regardless of valence (Bylsma et al., 2008), which has been referred to as the emotion context insensitivity (ECI)

hypothesis (Rottenberg et al., 2005). Notably, this meta-analysis also revealed significant heterogeneity in findings (Bylsma et al., 2008). One key factor here may be the importance of personal relevance of stimuli (Bylsma, 2021). For instance, *parental* feedback about adolescents' *personality*, may be particularly important as parents generally know their child very well, and parental feedback thus may shape a child's self-concept in a unique way (Harter, 2015). Moreover, adolescence is often accompanied by temporary increases in negative parent-adolescent interactions, including criticism (Smetana et al., 2006), which could be exacerbated in families with an adolescent with depression (McLeod et al., 2007). Hence, parental criticism may affect adolescents with depression in two ways. On one hand, it can be argued that criticism is more common for them and/or more consistent with their expectations, resulting in blunted emotional responses. This would be in line with the ECI hypothesis. On the other hand, adolescents with depression may be more sensitive to interpersonal evaluation and rejection, which might be due to their negative beliefs about themselves, resulting in increased reactivity to criticism (Bylsma, 2021). Understanding how responses to parental praise and criticism are altered in adolescents with depression may inform communication interventions and strategies targeting parent-adolescent dynamics. Therefore, investigating how adolescents with depression react to parental praise and criticism is a key objective of this dissertation (**Chapter 4**).

NEGATIVITY BIASES IN ADOLESCENT DEPRESSION

One key feature of depression is seeing the self in a negative light, both in the present and across time (Davey & Harrison, 2022). For instance, adolescents with depression endorse more negative and fewer positive trait words as self-descriptive compared with adolescents without psychopathology (Orchard et al., 2019), and preferentially rehearse negative autobiographical memories (Kuyken & Howell, 2006). This negativity bias is not only apparent in the self: individuals with depression show negative biases in numerous cognitive processes, such as attention, interpretation, and memory (Everaert & Koster, 2020). These negativity biases also have impact on (the enjoyment of) social relationships, often resulting in withdrawal from social interactions, fueling negative beliefs about the self, which further reinforces negative self-views. Furthermore, individuals with depression tend to have an increased self-focus. They spend more time thinking about the self, and have concentration difficulties when performing external tasks, resulting in even more (negative) self-related thoughts (Ingram, 1990). Hence, two other key objectives of this dissertation are i) investigating how reactions to parental feedback of adolescents with depression are affected by adolescents' own (negative) self-views (**Chapter 4**), and ii) elucidating how adolescents with depression relive a *positive* self, via positive autobiographical memories, when compared to a control group (**Chapter 5**).

NEURAL NETWORKS IMPLICATED IN ADOLESCENT DEPRESSION

Next to these behavioral and cognitive manifestations, and environmental influences, depression is characterized by aberrant functioning of the brain (Li et al., 2018). Broadly, prior neuroimaging studies suggest that individuals with depression show a hyperactive autobiographical memory network/default mode network, which anti-correlates with the central executive network – comprising dorsolateral PFC and posterior parietal cortex, sub-serving cognitive control of attention and emotion regulation – being *hypo*active in individuals with depression (Menon, 2011; Rayner et al., 2016). Additionally, depression has been related to aberrant functioning of the salience network, including AI, dorsal ACC, subgenual ACC, and the amygdala (Forbes et al., 2020; Hamilton et al., 2012; Jamieson et al., 2022; Menon, 2019; Menon & Uddin, 2010; Rappaport & Barch, 2020). Further, it has been well-established that (adolescent) depression is linked to reduced responses to *positive* or rewarding stimuli, accompanied by blunted VS activity (Keren et al., 2018; Ng et al., 2019). However, this finding is primarily based on studies involving monetary rewards, and not *social* reward such as parental praise.

When looking at studies involving social rewards in adolescents with depression, findings are less conclusive. For example, no differences were found between adolescents with depression and adolescents without psychopathology in striatal response to 'being liked' by peers (Davey et al., 2011) or peer acceptance (Silk et al., 2014). Moreover, to date, only one prior study examined neural responses to parental feedback in adolescents with depression, in this case, auditory maternal praise and criticism (Silk et al., 2017). Here, praise resulted in decreased activation in dorsal striatum (but not VS), as well as vmPFC and precuneus, whereas criticism resulted in increased activation in parahippocampal gyrus. With regards to neural responses to *positive* autobiographical memory recollection in depression, only two prior studies were conducted, and only in adult samples: Young et al. (2016) found decreased activity in the amygdala, while Parlar et al. (2018) found decreased activity in left AI and left parahippocampal gyrus. To address these gaps in the literature, two final key objectives of this dissertation will be investigating neural responses to i) parental praise and criticism (**Chapter 4**) and ii) positive autobiographical memory recollection (**Chapter 5**) in adolescent with depression compared to adolescents without psychopathology.

RE-PAIR

This dissertation is based on RE-PAIR, *'Relations and Emotions in Parent-Adolescent Interaction Research'*, a Dutch multi-method, two-generation study, supported by the Netherlands Organization for Scientific Research (NWO). In RE-PAIR, we investigate the bidirectional interplay between parent-adolescent interactions and adolescent mental well-being by comparing adolescents with a current depression (i.e., major depressive disorder (MDD) or dysthymia) to adolescents without psychopathology, and where possible, both their parents (see also Janssen et al., 2021; Wever et al., 2022). RE-PAIR was conducted

by members of the Clinical Psychology Department of Leiden University, the Netherlands, at the *Leids Universitair Behandel- en Expertise Centrum* (LUBEC) and *Leids Universitair Medisch Centrum* (LUMC) from June 2018 to March 2022. In total, 115 families participated in RE-PAIR: 35 adolescents with a current depression and their 63 parents, and 80 adolescents without psychopathology and their 153 parents.

The full RE-PAIR study consisted of four parts: i) online questionnaires, ii) an extensive lab session, iii) ecological momentary assessment (EMA) for 14 consecutive days, and iv) an fMRI-scanning session, see Figure 4. Furthermore, families were invited to complete online follow-up questionnaires half a year, one year, and two years after the lab session. The current dissertation particularly focuses on RE-PAIR data collected during the fMRI-scanning session. During the lab session at LUBEC, adolescents and one or both parents were invited for this fMRI-scanning session. In total, 22 adolescents with a current depression and 30 parents participated in the scanning session, as well as 63 adolescents without psychopathology and 63 of their parents. First, participants were accustomed to the scanning environment by means of a mock-scanner and received detailed task instructions. In the scanner, parents performed three tasks: i) an eye-contact task (Wever et al., 2022), ii) a parental empathy task (Wever et al., 2021), and a vicarious social feedback task (**Chapter 2**; van Houtum et al., 2021). Adolescents performed four tasks in the scanner: i) an eye-contact task (Wever et al., 2022), ii) a parental social feedback task (**Chapter 3, 4**; van Houtum et al., 2022), iii) a peer evaluation task (Will et al., 2017), and iv) an autobiographical memory task (**Chapter 5**). Upon completion of scanning, participants filled out several questionnaires, were subjected to a manipulation check interview, and were thoroughly debriefed about study purposes and the experimental set-up.

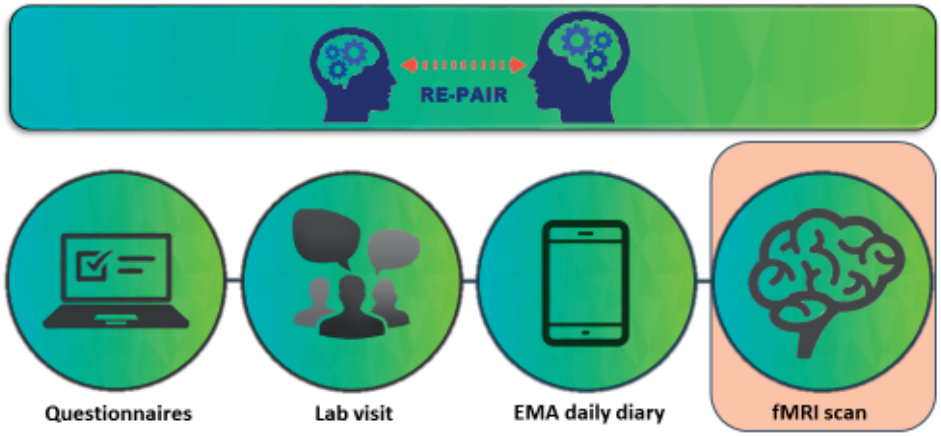

Figure 4. Overview of RE-PAIR study parts. The current dissertation particularly focuses on RE-PAIR data collected during the fMRI-scanning session.

DISSERTATION OUTLINE

This dissertation focuses on one of the main aims of The RE-PAIR study: to examine neural mechanisms underlying adolescents' social evaluations and self-views from a parent-adolescent perspective among healthy control adolescents and adolescents with depression, and their parents. First, neural sensitivity to social feedback in parents and adolescents, and influences of self-views were examined. That is, in **Chapter 2** it was investigated how parents react – both on an affective and neural level – to praise and critique about their adolescent child, and whether their affective and neural responses to such *vicarious* social feedback are modulated by parents' perceptions of their child. Given that excessive responses to feedback about the child may critically shape interpersonal dynamics of parent *and* child, and may even impact on how children view themselves, this is a crucial first step in examining social evaluation processing within the parent-adolescent context. **Chapter 3** describes a study that examined how *parental* praise and criticism impacts affective and neural responses of *adolescents without psychopathology*, and whether this depends on the consistency of the feedback with adolescents' existing self-views and/or on their perceptions of daily parental warmth and criticism. This provides a status quo view of how parental social feedback is processed by adolescents *without* psychopathology, and whether and how self-views are incorporated in this processing, before comparing it to adolescents with a current depression.

Second, to explore the self in adolescent depression, neural mechanisms related to self-processing in adolescents with depression as compared to adolescents without psychopathology were studied. **Chapter 4** reports on a study that investigated affective and neural responses to parental praise and criticism in adolescents with depression vs. adolescents without psychopathology. I explored whether these affective and neural responses are influenced by adolescents' self-views or their parent's general perception of them. Differences in processing of parental feedback may provide important insights into mechanisms supporting characteristics of depression, i.e., (neural) sensitivity to both positive and negative events, as well as the impact of having unrealistically negative self-views. **Chapter 5** presents a study which aimed to explore whether adolescents with depression would report reduced memory pleasantness and vividness during positive (and neutral) autobiographical memory reliving. Second, I explored whether spatial and temporal characteristics of neural (sub)networks are related to i) memory valence and vividness, and ii) adolescent depression during reliving. Understanding how adolescents with depression engage in *positive* memory imagery about the self could have promising clinical potential to target core features of depression, such as negative self-perceptions and low mood. Lastly, in **Chapter 6** the findings of the studies presented in this dissertation are summarized and possible clinical implications of these findings to treat, or even prevent adolescent depression, are discussed in detail.