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# Loneliness Across the Life Span

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**Pamela Qualter[1], Janne Vanhalst[2,3], Rebecca Harris[4], Eeske Van Roekel[5], Gerine Lodder[6], Munirah Bangee[1], Marlies Maes[2], and Maaike Verhagen[6]**

[1]School of Psychology, University of Central Lancashire, United Kingdom; [2]School Psychology and Child and Adolescent Development, KU Leuven - University of Leuven, Belgium; [3]Research Foundation Flanders, Belgium; [4]Department of Education and Psychology, University of Bolton, United Kingdom; [5]Interdisciplinary Center Psychopathology and Emotion Regulation, University Medical Center, University of Groningen, The Netherlands; and [6]Behavioural Science Institute, Radboud University, Nijmegen, The Netherlands

## Abstract

Most people have experienced loneliness and have been able to overcome it to reconnect with other people. In the current review, we provide a life-span perspective on one component of the evolutionary theory of loneliness—a component we refer to as the reaffiliation motive (RAM). The RAM represents the motivation to reconnect with others that is triggered by perceived social isolation. Loneliness is often a transient experience because the RAM leads to reconnection, but sometimes this motivation can fail, leading to prolonged loneliness. We review evidence of how aspects of the RAM change across development and how these aspects can fail for different reasons across the life span. We conclude with a discussion of age-appropriate interventions that may help to alleviate prolonged loneliness.

## Keywords

loneliness, affiliation, development, prevalence, life span, hypervigilance, social withdrawal, evolutionary mechanism

Most people have experienced loneliness at some point in their lives. For some people, it is a prolonged and painful experience, with deleterious effects on mental and physical health (S. Cacioppo, Grippo, London, Goossens, & Cacioppo, 2015, this issue; Van Dulmen & Goossens, 2013). For most people, however, loneliness is a transient experience without long-lasting negative consequences. According to the evolutionary theory of loneliness (J. T. Cacioppo et al., 2015, this issue), loneliness is usually transient in nature because the aversive feelings associated with loneliness motivate individuals to reconnect with other people. For simplicity, we refer to this aspect of the evolutionary model as the reaffiliation motive (RAM).

The RAM is thought to consist of three component processes that promote reconnection. First is the aversive feeling of loneliness, which evolved to signal to people that their connections were broken or under threat and motivated attention to their maintenance or repair (J. T. Cacioppo, Cacioppo, & Boomsma, 2014; J. T. Cacioppo et al., 2006). Second, the awareness that one is lonely activates the behavioral reaffiliation process, which causes people to withdraw from social situations (Gardner, Pickett, Jefferis, & Knowles, 2005; Pickett & Gardner, 2005; also see J. T. Cacioppo et al., 2015). Third, loneliness has been proposed to increase implicit vigilance for social threat (J. T. Cacioppo & Hawkley, 2009; J. T. Cacioppo et al., 2015). When these component processes of the RAM work well, they promote the development of salutary relationships with others (J. T. Cacioppo & Hawkley, 2005; J. T. Cacioppo et al., 2006; Gardner et al., 2005; Masi, Chen, Hawkley, & Cacioppo, 2011).

Our review of the ontogeny of loneliness is organized around three questions regarding the RAM. First, how do the environmental triggers of loneliness differ across the life span? Second, how are maturational and developmental risk factors for loneliness related to the RAM? Finally, what are the implications of these developmental

**Corresponding Author:**
Pamela Qualter, School of Psychology, University of Central Lancashire, Fylde Road, Darwin Building, Preston, Lancashire, PR1 2HE, United Kingdom
E-mail: PQualter@uclan.ac.uk

aspects of the RAM for intervention when loneliness becomes prolonged? On the basis of evidence presented, we propose a strategy for the development of interventions in which attention biases and behavior that accompany prolonged loneliness at specific stages in development are targeted. Table 1 summarizes the main conclusions of each step in this article. Figure 1 illustrates the component processes of the RAM and shows how this mechanism might fail, promoting prolonged loneliness across development.

## Sources of Transient and Prolonged Feelings of Loneliness Across Ontogeny

The need to affiliate with others has been demonstrated across the life span (Baumeister & Leary, 1995), with loneliness being reported by people of different ages (Heinrich & Gullone, 2006). However, differences exist in sources of loneliness at different ages, and these differences are associated with changes in belonging needs evidenced across ontogeny (Parkhurst & Hopmeyer, 1999). In Table 1, we present an overview of these developmental changes in the source of loneliness.

One of the first sources of loneliness is peer friendship. In early childhood, forming and maintaining friendships are mainly based on characteristics such as proximity and sharing common activities, but throughout childhood, the quality of friendships becomes increasingly important. Children move from simply wanting to be physically close to others to wanting close friendships that are characterized by validation, understanding, self-disclosure, and empathy (Bigelow, 1977; Parker & Asher, 1993). Expectations about friendship quality continue to develop throughout adolescence and young adulthood, with an increasing focus on intimacy (Buhrmester, 1990; Steinberg & Morris, 2001). Thus, whereas friendship quantity may be more important in predicting loneliness in young childhood, friendship quality appears to be more important in late childhood and adolescence.

A second important source of loneliness is the peer group. In early childhood, belonging to a peer group does not seem to be a main concern (Parkhurst & Hopmeyer, 1999), although extreme signs of peer exclusion such as peer victimization have been linked to loneliness in kindergarteners (Kochenderfer-Ladd & Wardrop, 2001). As they age, children become increasingly aware and concerned about being accepted by the peer group, and peer rejection is related to feelings of loneliness in childhood (Gifford-Smith & Brownell, 2003). By adolescence, concerns about one's standing within the social group increase (Crone & Dahl, 2012). Adolescents want to be liked by a close friend, but they also have a desire to be liked by the whole peer group. Indeed, lacking friends, low friendship quality, peer rejection, and victimization are all predictors of loneliness in adolescence (Vanhalst, Luyckx, & Goossens, 2014).

Later in adolescence and during young adulthood, the focus on social status decreases, but the need for intimate friendships is maintained. Moreover, a third important source of loneliness—romantic relationships—is increasingly valued (Collins, Welsh, & Furman, 2009). Over the course of adolescence, romantic experiences become more normative, and the quality of one's romantic relationship becomes increasingly important (Dush & Amato, 2005). During this stage in social development, there is a move from simply wanting a romantic partner to wanting a committed, high-quality romantic relationship. For example, analyses of intact and broken-up relationships in college revealed that relational satisfaction was associated with lower levels of loneliness, whereas relational disappointment was associated with higher levels of loneliness (Flora & Segrin, 2000). Marital status continues to predict loneliness throughout adulthood (Diener, Gohm, Suh, & Oishi, 2000), but marital quality is superior to marriage per se in explaining individual differences in loneliness (Hawkley et al., 2008). In older age, a number of specific risk factors for loneliness emerge; these factors pose challenges to established romantic relationships, such as losing a partner, reduced social activities because of increased physical disability and poor health (Dykstra, Van Tilburg, & De Jong Gierveld, 2005), and being confronted with a partner's increasing frailty (Dykstra et al., 2005).

Table 1 shows how there are substantial changes in people's social experiences and expectations across development. These changes increase the likelihood of social disconnection and opportunities for reconnection in specific ways. When these changes in the social environment are also accompanied by major physical and psychological developmental shifts, researchers have found the highest loneliness prevalence rates. Specifically, the percentage of people feeling lonely "sometimes" or "often" is highest during adolescence when youths enter puberty and are faced with the challenge of establishing their own identity; however, this percentage is also highest during old age when there is increasing frailty and decreased mobility accompanied by the loss of loved ones. The percentage of people reporting feeling lonely "sometimes" or "often" is estimated to be less than 20% of children 7–12 years of age (Bartels, Cacioppo, Hudziak, & Boomsma, 2008), between 20% and 71% of late adolescents and young adults (Brennan, 1982; Hawthorne, 2008; Rönkä, Rautio, Koiranen, Sunnari, & Taanila, 2014), between 11% and 30% of middle-age adults (Dykstra et al., 2005; Griffin, 2010; Hawthorne, 2008), and between 40% and 50% of adults older than 80 years of age

**Table 1.** Loneliness Across Ontogeny: Source and Prevalence of Loneliness, Evidence for Components of the Reaffiliation Motive (RAM), and Appropriate Interventions

| Stage of development | Age range in years | Belonging needs | Sources of loneliness | Prevalence of people feeling lonely "sometimes" or "often" | Components of the RAM | | | Negative thinking that affects the success of the RAM | Proposed intervention |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Evidence of motivation to reconnect | Evidence for vigilance to social cues | Evidence for social withdrawal | | |
| Young childhood | 3–7 | Shared fun activities | Lack of a play partner, victimization | | Children >5 years offer valid definitions of loneliness. They discuss aversive feelings, such as sadness, and ways to cope with loneliness by making contact with others. | | Shyness, withdrawn behavior | Distrusting others, low self-worth | |
| Middle–late childhood | 7–12 | Allies, confidants, sense of being liked by a close friend | Lack of a close friend, victimization by the peer group, peer rejection | 20% | ✓ | Difficulty disengaging from visually presented rejection stimuli; sensitive to signs of rejection, fear, negative evaluations | Shyness, withdrawn behavior | Maladaptive attribution style (attribution of control to external loci), distrusting others, low self-worth | Attention reprogramming: Highlight important aspects of social scenes and enable disengagement from social threat stimuli to aid reconnection. Priming acceptance to promote reconnection. Retraining negative thoughts: Addressing counterproductive attitudes and negative thoughts (external, loci of control, low trust beliefs, low self-worth). |

*(continued)*

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| Stage of development | Age range in years | Belonging needs | Sources of loneliness | Prevalence of people feeling lonely "sometimes" or "often" | Components of the RAM | | | Negative thinking that affects the success of the RAM | Proposed intervention |
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| Early adolescence | 12–15 | Acceptance by peer group | Lack of a close friend, nonacceptance by peer group/clique, victimization | 11%–20% | ✓ | More reactive to social environment; increased responses to both positive and negative environments; sensitive to signs of rejection, fear, and negative evaluations | Passivity in social interactions and withdrawn behavior | Maladaptive attribution style (attribution of control to external loci), distrusting others, low self-worth, anxiety | Attention reprogramming: Coping with social threat, noting important aspects of social scenes and use of information to direct behavior change. Priming acceptance to promote reconnection.<br>Retraining negative thoughts: Addressing counterproductive attitudes and negative thoughts (external loci of control, low trust beliefs, low self-worth). Inclusion of tasks to address anxiety around reconnection. |
| Late adolescence/ young adulthood | 15–21 | Validation and understanding from a close friend; romantic relations, flirtations, acceptance as a possible mate; marital status | Lack of close friend, lack of romantic relationship, nonacceptance as possible mate | 20%–71% | ✓ | Remember more social events; visual cortex activation greater for unpleasant social pictures compared with objects; enhanced attention to facial and vocal expressions of emotion; sensitive to signs of rejection, fear, and negative evaluations; initial visual vigilance of rejection stimuli and attentional avoidance | Withdrawn behavior | Personality traits, low self-esteem, anxiety, low levels of trust | Attention reprogramming: Coping with social threat, noting important aspects of social scenes and use of information to direct behavior change. Priming acceptance to promote reconnection.<br>Retraining negative thoughts: Addressing counterproductive attitudes and negative thoughts (external loci of control, low trust beliefs, low self-worth). |

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| Stage of development | Age range in years | Belonging needs | Sources of loneliness | Prevalence of people feeling lonely "sometimes" or "often" | Components of the RAM | | | Negative thinking that affects the success of the RAM | Proposed intervention |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Evidence of motivation to reconnect | Evidence for vigilance to social cues | Evidence for social withdrawal | | |
| Early and midlife adulthood | 21–50 | Quality of marital relationship—focus is on intimacy | Lack of intimate friendships or romantic relationship | 11%–30% | ✓ | | Withdrawn behavior, passivity in social interactions | Maladaptive attribution style (attribution of control to external loci) | Evidence of negative thinking that may reduce effectiveness of the cognitive reaffiliation motive in early adulthood. The behavioral reaffiliation process appears to work as in other stages. Cognitive retraining and cognitive behavior therapy are effective. Need to conduct studies in which the cognitive reaffiliation mechanisms are examined to ensure that these intervention strategies are age appropriate. |
| Mature adulthood and old age | 50+ | Marital quality—focus on intimacy and life partnership | Lack of intimate friendships or romantic relationship; loss of a partner in old age and ill-health from mature adulthood onward; reduced social activities | 40%–50% | ✓ | | Withdrawn behavior | Lack of perceived control, attribution style (attribution of control to external loci) | No examination of cognitive reaffiliation process, but the behavioral reaffiliation process appears to work in the same way as in other stages. Negative thinking influences prolonged loneliness in the same way as in other stages. Cognitive retraining and cognitive behavior therapy have also been shown to be effective. |

Note: The check mark indicates age groups that also discussed aversive feelings such as sadness when describing loneliness. They also discussed ways to overcome loneliness and referenced the need to reconnect with other people.

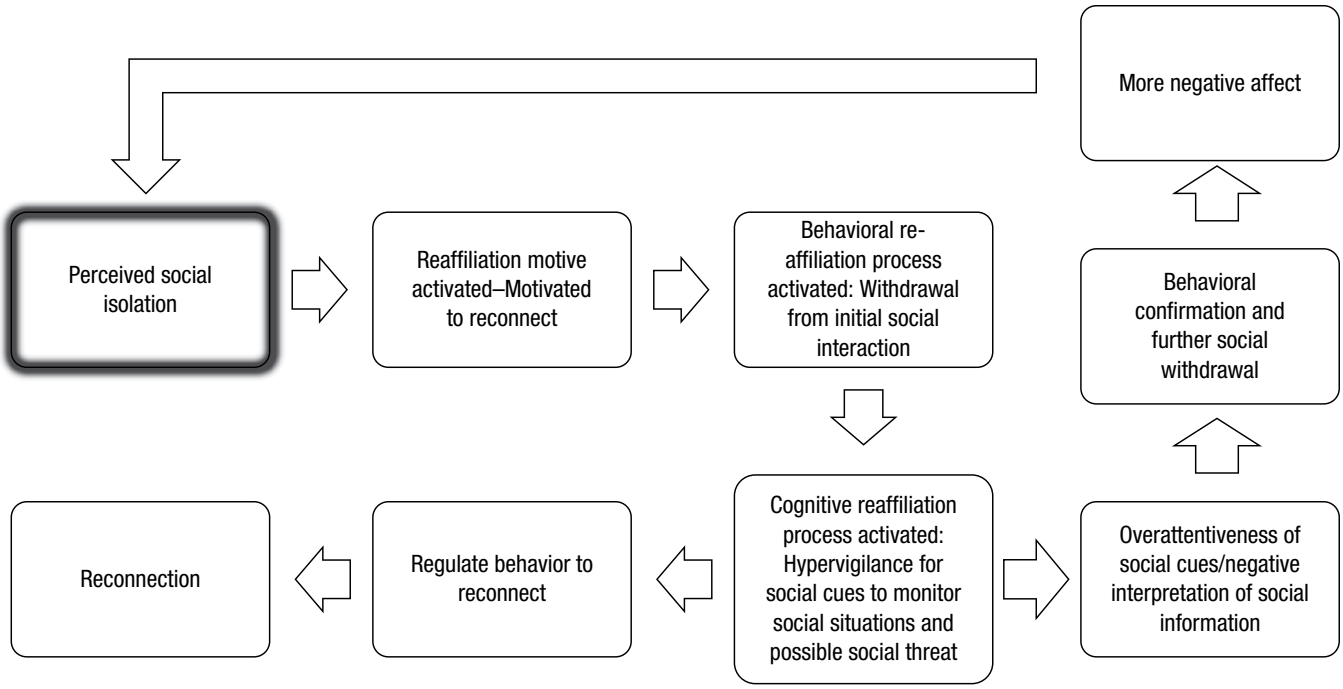


**Fig. 1.** The activation of the reaffiliation motive (RAM). The highlighted "perceived social isolation" box is the starting point of the process. The figure shows how RAM works for transient and prolonged loneliness. Prolonged loneliness is associated with negative cognitive biases, which affect RAM during the cognitive reaffiliation process. Negative cognitive biases mean that social cues are viewed or interpreted negatively, eliciting behaviors from others that confirm the lonely person's perceptions and feelings of disconnection. This leads to further withdrawal and engagement in a self-reinforcing loop as described by J. T. Cacioppo and Hawkley (2009), which leads to increasing feelings of loneliness. The model shows that exit from the RAM comes at the point of hypervigilance and social monitoring, in which intervention could lead an individual who has previously experienced prolonged loneliness to make appropriate behavioral changes and reconnect with others.

(Demakakos, Nunn, & Nazroo, 2006; Dykstra et al., 2005; Victor, Scambler, Bowling, & Bond, 2005).

In addition to the normative changes in sources and prevalence across development, there appears to be a small subgroup of people who are at risk for prolonged feelings of loneliness; such people are not identified in analyses in which the mean levels of loneliness are the focus. This subgroup consists of individuals who report persistent loneliness over many years and report feeling socially or emotionally distant from others. In several multiwave longitudinal studies, researchers investigating developmental trajectories of loneliness from childhood through early adulthood have indicated that between 3% and 22% of people experience prolonged loneliness (Benner, 2011; Harris, Qualter, & Robinson, 2013; Jobe-Shields, Cohen, & Parra, 2011; Ladd & Ettekal, 2013; Qualter, Brown, et al., 2013; Schinka, Van Dulmen, Mata, Bossarte, & Swahn, 2013; Vanhalst, Goossens, et al., 2013; Vanhalst, Rassart, et al., 2013). Further, despite a dearth of studies in which researchers investigated prolonged loneliness in middle adulthood, stability and change in loneliness among older adults have been investigated by researchers using retrospective and longitudinal designs. Evidence suggests that 15%–25% of older adults experience social or emotional isolation from others for many months or years (Cohen-Mansfield, Shmotkin, & Goldberg, 2009; Dykstra et al., 2005; Jylhä, 2004; Newall, Chipperfield, & Bailis, 2013; Victor et al., 2005). In all of these studies, those individuals following a trajectory of high stable or increasing loneliness showed relatively poor mental and physical health.

We next turn to the aspects of RAM that vary across development. From an evolutionary perspective, loneliness itself is not problematic at any age any more than is hunger, thirst, or pain. Similar motivational, behavioral, and cognitive processes may, therefore, be observed during transient periods of loneliness across the life span as long as the RAM is effectively leading to social reconnection. However, faulty RAM components across the life span may contribute to individuals falling into the depths of prolonged loneliness.

## Motivation to Reconnect Across Ontogeny

In 1953, Sullivan argued that loneliness was a strong motivational force across development. J. T. Cacioppo et al. (2006) posited that just as physical pain is an aversive signal that evolved to motivate a person to take action to minimize damage to one's physical body,

loneliness is an aversive state that motivates a person to minimize damage to one's social body. Empirical evidence supports that claim and shows that this motivation is evident across human development.

Loneliness is viewed as an aversive state across the life span, with children as young as 5 years of age offering valid definitions of loneliness and discussing the associated aversive feelings, such as sadness and aloneness (Cassidy & Asher, 1992). School-age children also discuss the various interpersonal contexts associated with loneliness, including loss, temporary absence, and psychological distance (Hymel, Tarulli, Hayden Thomson, & Terrell-Deutsch, 1999). Children aged 5 years and older have clear ways of coping with loneliness, reporting the need to make contact with others (Besevegis & Galanaki, 2010; Qualter, 2003; Qualter & Munn, 2002). Such descriptions of loneliness are comparable with definitions offered by adults (Jones, Cavert, Snider, & Bruce, 1985; Rokach, 1989; Weiss, 1973). Together, these studies show that loneliness appears to motivate people across ontogeny to reconnect with others.

Earlier in this review, we noted that there are different sources of loneliness across development and a change in focus from quantity of relationships to the quality of those relationships. These changes mean that people often find themselves unsure of their social environment and unsafe because they do not know whom they can trust or confide in. Thus, although it appears to be the case that loneliness motivates even young children to attend and seek connection with other people, it also appears that loneliness can lead to other behaviors, including increased withdrawal and attention to social threat. These behaviors are discussed later (also see J. T. Cacioppo et al., 2015).

## *The behavioral reaffiliation process across ontogeny*

According to the RAM, the aversiveness of loneliness motivates people to withdraw from social encounters. On first thought, such behavior seems odd, as withdrawing is likely to evoke even greater loneliness. However, withdrawing allows the next link in the mechanism—the cognitive reaffiliation process—to work effectively: By withdrawing from immediate social encounters, people are able to assess the level of threat and determine whether they need to find other ways of behaving to reaffiliate with others (J. T. Cacioppo & Hawkley, 2009; Gardner et al., 2005). There is evidence to support the thesis that lonely people across ontogeny (and across phylogeny; see J. T. Cacioppo et al., 2015) display social withdrawal (see Table 1).

Empirical studies show that lonely adults are often more withdrawn than their nonlonely peers (Watson & Nesdale, 2012), avoid others (Nurmi, Toivonen, Salmela-Aro, & Eronen, 1997), and are more passive in social interactions (Jones, Hobbs, & Hockenbury, 1982). Cross-sectional and experimental research in which loneliness was induced showed that transient loneliness was associated with higher levels of shyness and fear of negative evaluation (J. T. Cacioppo et al., 2006). Similar behavioral profiles have been found for children and adolescents, with higher loneliness associated with higher levels of shyness and withdrawn behavior during social engagement (Cassidy & Asher, 1992; Qualter & Munn, 2002; Qualter, Rotenberg, et al., 2013; Rotenberg, 1994).

Although immediate, limited social withdrawal may be generally adaptive because a person is able to observe and then make judgments about appropriate social engagement, general and prolonged social withdrawal limits opportunities for social reconnection and can promote prolonged loneliness (Jobe-Shields et al., 2011). In addition, children who experience prolonged loneliness and who become increasingly withdrawn limit their opportunities to practice their social interaction skills, becoming more deficient in social skills over time (Schinka et al., 2013). Figure 1 shows how social withdrawal might work as part of RAM but also how it might lead to problems with reconnection.

## *The cognitive reaffiliation process across ontogeny*

Activation of the RAM increases people's attention to social stimuli to promote reconnection to other people. Evidence from adult studies demonstrates increased vigilance to social cues in lonely people. In Table 1, we provide an overview of these findings, which shows that loneliness in (young) adulthood is associated with remembering more social events (Gardner et al., 2005), enhanced attention to facial and vocal expressions of emotion (Gardner et al., 2005; Pickett, Gardner, & Knowles, 2004), greater activation of the visual cortex in response to unpleasant social pictures of people compared with objects (J. T. Cacioppo, Norris, Decety, Monteleone, & Nusbaum, 2009), initial visual vigilance to pictures depicting social rejection (Bangee, Harris, Bridges, Rotenberg, & Qualter, 2014), and sensitivity to signs of rejection and fear of negative evaluation (Jackson, 2007; Watson & Nesdale, 2012). Studies with lonely children and adolescents have shown them to have difficulty disengaging from rejection stimuli during an eye-tracker task (Qualter, Rotenberg, et al., 2013) and have highlighted their sensitivity to signs of rejection (Jackson,

2007; Qualter, Rotenberg, et al., 2013). Further, results from experience-sampling studies of early adolescents in which researchers examined the responses of lonely individuals to the social context showed that lonely individuals were more reactive to the social environment, with increased responses to both positive and negative environments (Van Roekel et al., 2013; Van Roekel, Scholte, Engels, Goossens, & Verhagen, in press).

Overall, eye-tracking studies with lonely adults and lonely children suggest an increased vigilance to social threat, even though the presentation is different. For example, whereas lonely children had difficulty disengaging from social threat stimuli, lonely young adults displayed only an initial vigilance to social threat stimuli, which can be explained by developmental changes in attention processing. The initial vigilance pattern of processing is thought to be automatic, unintentional, and outside voluntary control, whereas the later stages of attention are thought to be strategic, intentional, and under voluntary control (Cisler & Koster, 2010). This means the latter stages are influenced by developmental changes in cognitive processing, particularly the relocation of attention (Casey, Galvan, & Hare, 2005) and perspective taking (Blakemore, 2008). Thus, differences in attention processing of social threat information between lonely children and lonely adults could be explained by typical changes in information processing across ontogeny and by implicit versus explicit attentional processes in adults (J. T. Cacioppo et al., 2015).

The eye-tracker studies by Qualter, Rotenberg, et al. (2013) and Bangee et al. (2014) show that very lonely children are having trouble disengaging, but very lonely young adults have a practiced avoidance of social threat. It is possible that the short initial vigilance to the social threat is long enough for adults to gather social information to then use to reconnect, but this may not be the case, with lonely young adults actually avoiding the social threat information. These differences may be explained by typical changes in information processing, but prospective research is needed to determine whether these differences represent a developmental change that reflects the emergence of problems with the innate mechanism being considered here. It is possible that when a person experiences failed attempts at reconnection across childhood and adolescence, the basic vigilance system becomes calibrated away from social information over time; this then limits future reconnection. It may also be the case that vigilance is affected by developmental changes in executive functioning that enable an individual to redirect his or her attention to manage aversive emotions at the cost of attending to contextual information in the social environment that would promote reconnection. Such notions must be tested in future empirical work because of the implications for interventions.

## *Individual differences that affect the RAM*

Multiple studies with children, adolescents, and adults have shown that some lonely people differ from their nonlonely peers in the ways that they interpret social encounters and deal with difficulties in relationships. These negative interpretations have often been considered to be part of the cognitive component of the RAM. However, longitudinal research shows, instead, that they determine the effectiveness and efficiency of the RAM by influencing the interpretation of information gathered during the operation of the cognitive component of the RAM or because they affect approach-oriented behavior. This evidence is more in line with the evolutionary model of loneliness (see J. T. Cacioppo et al., 2015) and the finding that people who experience prolonged loneliness tend to form more negative social impressions of others.

Evidence suggests that loneliness is related to more negative interpretations of the behavior of others as well as to an underestimation of the social standing and social abilities of others. This occurs in childhood and adolescence (Qualter & Munn, 2002; Vanhalst, Luyckx, Scholte, Engels, & Goossens, 2013) as well as adulthood (Duck, Pond, & Leatham, 1994; Jones, Freemon, & Goswick, 1981; Jones, Sansone, & Heim, 1983). Further, lonely people are low in trust for others (Rotenberg, 2010), and they have specific attribution styles that are not conducive to change (J. T. Cacioppo et al., 2000; Crick & Ladd, 1993; Moore & Schultz, 1983; Nurmi et al., 1997; Qualter & Munn, 2002; Renshaw & Brown, 1993). These findings from cross-sectional studies support the idea that loneliness is often associated with cognitive biases that promote negative thinking. Currently, there is no study examining whether these negative thoughts are a direct result of implicit increases in social vigilance as an outcome of loneliness or lead to loneliness. However, there is evidence that they promote prolonged loneliness.

Table 1 summarizes findings from prospective studies of loneliness that show that maladaptive cognitive biases (e.g., distrusting others) put children at heightened risk for an increasing and stable high loneliness trajectory (Qualter, Brown, et al., 2013). Further, several intrapersonal factors, such as low self-worth and personality traits (e.g., introversion and emotional instability), have been found to predict prolonged loneliness across childhood, adolescence, and adulthood (Dykstra et al., 2005; Newall et al., 2013; Qualter, Brown, et al., 2013; Vanhalst, Goossens, et al., 2013). Low self-worth, low trust of others, and the attribution of control to external loci appear

to be maintaining and exacerbating factors of loneliness across ontogeny, perhaps because they provide a foundation for the belief that loneliness cannot be remedied (Laursen & Hartl, 2013; Qualter, Brown, et al., 2013). Thus, it is possible that when the RAM is activated by lonely people with low self-worth, low trust of others, and external loci of control, negative thinking that hinders reconnection increases; such negative thinking then influences the interpretations of social information gathered from the cognitive reaffiliation process and leads to prolonged loneliness. This explanation offers some ideas for future intervention strategies that are discussed in S. Cacioppo et al. (2015) and that we return to later.

Prospective studies have also shown that there may be biological and genetic influences on the effectiveness of the RAM (see Goossens et al., 2015, this issue). For example, prolonged loneliness is associated with genes that are linked to faulty cognitive and attention processing, including those related to sensitivity to emotional or social information (5-HTTLPR: Beevers, Wells, Ellis, & McGeary, 2009; OXTR: Theodoridou, Rowe, Penton-Voak, & Rogers, 2009) as well as those related to attentional control, reward sensitivity, and working memory (DRD2: Cohen, Young, Baek, Kessler, & Ranganath, 2005; Gelao et al., 2014). Goossens et al. argued that people with a specific genetic variant may act in ways to create circumstances that make them more lonely: They may be less trusting of others and less prosocial, making social reconnection more difficult. Thus, although it is important that lonely people increase their surveillance of negative social cues in the social environment to reconnect with others, certain individual differences (e.g., low self-worth, certain attribution styles, personality traits) and genetic profiles make some people overly sensitive to emotional and social information, which may lead to increased feelings of loneliness over time.

## Intervention Strategies Across Ontogeny That Address Faults in the RAM

In this review, we have pointed to ways in which the processes involved in the RAM might contribute to prolonged loneliness. In this section, we use that knowledge to argue for certain prevention programs and interventions in which the changing presentation of the RAM across ontogeny is considered.

### *Attention retraining and priming acceptance*

Earlier, we discussed the presentation of the cognitive reaffiliation process and how it was characterized by different patterns of visual processing across ontogeny. We discussed the fact that lonely children had difficulty disengaging from social threat, but lonely young adults appeared to show a practiced attentional avoidance of the same social threat stimuli. These differences could represent a developmental change that reflects the emergence of a problem in the RAM: During childhood, the focus on social threat may be adaptive because it motivates children to reconnect and provides clues about how to reengage, but avoidance of social threat information among lonely young adults may indicate a tendency to disconnect from the self and emotions in socially threatening situations. This difference in visual attention processing between children and adolescents (a) may be the outcome of improved cognitive skills that enable adults to redirect attention away from threatening information or (2) may happen for adults who as children and adolescents had intact RAM and who used the RAM to attempt reconnection but failed, with the vigilance system being regulated away from social information. In future longitudinal work, researchers should examine these developmental changes in more detail. If this process is correct and the developmental changes reflect an emergence of a problem with RAM, both prevention programs and interventions can be proposed. We offer some suggestions here.

The finding that loneliness is associated with failure to disengage from social threatening information during childhood could be targeted for prevention or intervention if it is found that such heightened vigilance does not promote reconnection. Prevention programs could teach all children what to focus on in social environments so that they gather contextual information that can be used to direct changes in behavior and thought as well as to facilitate reconnection with others. Promoting social and emotional competence generally, with an effective curriculum (Greenberg, Kusche, Cook, & Quamma, 1995), might prove successful, but a focus on contextual information that can influence reconnection may be especially effective. Researchers using such an approach could target lonely children for attentional training by using tasks that elicit selective attention to social threat (e.g., emotional faces or dot-probe tasks; Koster, Crombez, Verschuere, & De Houwer, 2004; Norman, Lawrence, Iles, Benattayallah, & Karl, 2014). We would expect this type of intervention to prove successful for lonely children who also have high levels of anxiety surrounding reconnection.

Interventions could also be offered to lonely adults to help them redirect their attention to social information that could be used to guide interpersonal behavior and to motivate them to reconnect. Indeed, interventions designed to accentuate the social gains and positive social features in the environment (e.g., a promotion-focused

mind-set) have been shown to be successful in increasing reaffiliation (Lucas, Knowles, Gardner, Molden, & Jefferis, 2010). Further, such interventions have been shown to modulate amygdala reactivity to threat (Norman et al., 2014), suggesting that priming acceptance changes brain functioning. Table 1 shows how attention retraining (programming) and priming acceptance would be different for different age groups on the basis of the currently available empirical findings.

It is possible that the priming of social acceptance increases social reconnection because it corrects a faulty RAM. Tests of this hypothesis are needed because they may provide new foci for intervention. Researchers of such studies should utilize eye-tracking technology to examine visual attention, but they should also use brain-imaging techniques to elucidate different attention profiles and amygdala reactivity to social threat for lonely people at different developmental stages. Findings from such studies will help to further inform appropriate intervention.

These attention retraining and priming interventions may also be effective for people who have a genetic profile (e.g., the less efficient variant of the serotonin transporter gene; see Goossens et al., 2015) that could result in overattention to potential social threat when aversive feelings associated with loneliness are activated. Attention retraining could be recommended for such people because it redirects their attention to useful social information and retrains the brain's response to social threat. There may be some strengths to having this specific genetic profile that could also be utilized in an intervention. For example, the serotonin transporter gene increases vigilance to social threat, but it also increases interpersonal sensitivity (Fiedorowicz et al., 2007) and shows strong associations with social support and mood state (Kaufman et al., 2004; Van Roekel et al., 2010). Those findings suggest that the building blocks for successful relationships are in place, which should mean that priming acceptance is likely to be successful at correcting the faulty RAM and reestablishing connection with others.

## *Cognitive behavior therapy (CBT)*

Earlier, we highlighted the fact that negative thinking influences the effectiveness of the RAM, and increases the risk of prolonged loneliness. Thus, we would expect interventions that address maladaptive social cognitions to be effective in helping people who experience prolonged loneliness. That hypothesis has found empirical support, with a meta-analysis of loneliness interventions showing that the programs targeting maladaptive social cognitions were the most effective at reducing feelings of loneliness (Masi et al., 2011; also see S. Cacioppo et al., 2015). The meta-analysis included few interventions of that kind for lonely children and none for lonely adolescents; however, on the basis of the evidence presented in this article that negative thinking can cause the RAM to fail across ontogeny, we propose that interventions targeting maladaptive social cognitions are likely to be effective across development. Thus, CBT offers an intervention that helps lonely people across ontogeny become aware of counterproductive attitudes and negative thought patterns that hinder reconnection. Table 1 shows that the focus of these negative thoughts will be on different social relationships that depend on the development stage. This means that CBT designed to help lonely people should focus on specific sources of loneliness at each developmental stage. Evidence that changes in the perception of control can reduce loneliness over time in an older adult population (Newall et al., 2013) by changing how that attitude is expressed through behavior supports the idea that changing cognitions leads to reconnection via changes in behavior. This approach would also help people who have intact RAM but who feel anxious about reconnection and who show increasing withdrawn behavior.

## *Increasing opportunities for social interaction*

Within the literature on loneliness, there is the argument that increasing social contact and opportunities for social reconnection could reduce loneliness (Qualter, 2003), but reviews (S. Cacioppo, 2015; Masi et al., 2011) provide strong empirical evidence that there are no significant effects of such interventions. However, that literature is limited to specific age groups and does not distinguish between lonely people who experience transient versus prolonged loneliness. Without randomized control trials, researchers do not know whether interventions that aim to reduce social isolation and increase opportunities for reconnection are useful for certain lonely groups. Specific groups of lonely people that might benefit from such interventions, but for whom empirical data are not available, are those who are unable to reconnect because they have few opportunities to engage with others.

## *Summary of interventions*

In this section, we discussed both prevention programs and targeted interventions for people with prolonged loneliness. Meta-analyses in which depression was examined indicate that targeted intervention programs may be more effective than universal prevention programs, with the latter showing very small to no effects (Horowitz & Garber, 2006; Merry et al., 2011). These findings should be considered when designing programs to help lonely

people, and they have informed our choice of recommended programs across ontogeny: When we felt a prevention program could have impact, we made proposals for that; however, when we felt there was an individual risk factor that needed to be targeted, we suggested a targeted intervention approach. We were also conscious of the fact that prevention work is easier in schools in which all children or adolescents are brought together, and we have been mindful of research that shows the negative effects of being identified for intervention programs (Evans, Scourfield, & Murphy, 2014). Prevention work is, of course, very difficult after individuals exit the school and university systems, suggesting that targeted interventions may be more appropriate in adulthood.

## Conclusions and Future Directions in Loneliness Research

In the current article, we have provided a life-span perspective on one of the components of the evolutionary theory of loneliness, the RAM, which includes the aversive feelings of loneliness that activate the behavioral and cognitive reaffiliation processes. We have reviewed evidence that the cognitive reaffiliation process may become faulty when lonely people have certain intrapersonal characteristics or are in social environments that make them hypervigilant to social threats, creating a self-reinforcing loop (J. T. Cacioppo & Hawkley, 2009) and that includes increased withdrawal and prolonged loneliness. However, there is no empirical work documenting whether and when an adaptive heightened orientation to social cues turns maladaptive. There is also no study that shows how the cognitive reaffiliation process actually affects behavior or whether behavior change is a separate parallel reaffiliation process that is also affected by individual differences. Thus, there is a need for researchers to examine both transient and prolonged loneliness in future work and to investigate the prospective associations among the components of the RAM using longitudinal designs. We believe that this represents a major overarching direction for future research on loneliness across ontogeny.

### *What does a faulty RAM component look like?*

With the absence of longitudinal work, it is difficult to establish whether the attentional avoidance shown by very lonely adults (Bangee et al., 2014) is a practiced avoidance strategy that helps people with prolonged loneliness cope with perceived threat instead of a typical presentation of this reaffiliation process. In future longitudinal research, investigators should examine (a) whether there are changes in the presentation of the cognitive reaffiliation process that accompany changes in cognitive development, (b) what characterizes an adaptive versus faulty cognitive reaffiliation process across development (i.e., is transient loneliness presented as a certain type of increased vigilance, but prolonged loneliness as disengagement difficulty or practiced avoidance depending on stage of development?), and (c) why this adaptive process for reaffiliation fails to work at different stages of development.

In addition, although there is evidence from prospective research that negative thinking (e.g., general mistrust and external loci of control) influences the maintenance of, or increase in, loneliness, researchers know little about how such biases influence the component processes of the RAM. The use of experimental cognitive paradigms, observational methods, and prospective designs in those studies will be important. Table 1 shows the need to also examine the cognitive reaffiliation process in middle adulthood and old age so that researchers can examine whether there are changes in the presentation of this mechanism at later stages of development.

### *Gender differences in loneliness*

It is unclear whether there are gender differences in loneliness or whether the RAM works differently for male and female individuals. In recent studies, researchers who examined gender differences in the stability of loneliness produced mixed results (Benner, 2011; Harris et al., 2013; Newall, Chipperfield, & Ballis, 2013; Qualter, Brown, et al., 2013; Vanhalst, Goossens, et al., 2013; Van Roekel et al., 2013); researchers who examined the cognitive biases and behavior of lonely people have typically not examined gender differences or produced mixed findings (Heinrich & Gullone, 2006). This is also the case with researchers who have examined the cognitive reaffiliation process. If aversive feelings of loneliness motivate people to reconnect and activate the RAM as well as its behavioral and cognitive components, and this mechanism is seen across ontogeny, then there are unlikely to be gender differences. However, there may be gender differences in whether the component parts of the RAM are successfully used, and there may be interactions with specific intrapersonal factors. Thus, it is difficult to say whether there are gender differences in transient loneliness, whether gender influences the effects of loneliness on cognitive biases and behavior, and whether such differences vary across ontogeny. Thus, in future research on loneliness, investigators need to make a concerted effort to examine and report gender differences.

### *Cultural differences in loneliness*

Even though loneliness appears to be a common experience across ontogeny, it is likely to be influenced by cultural factors. Cultures may differ in their beliefs on the

virtues and purposes of time spent alone (Jones, Carpenter, & Quintana, 1985) and on norms and expectations about relationships across the life span (Van Staden & Coetzee, 2010). However, there is limited cross-cultural research on loneliness (Hawkley, Gu, Luo, & Cacioppo, 2012) and no consensus regarding prevalence of loneliness as a function of individualistic versus collectivistic cultures (Chen et al., 2004). Cross-cultural studies should also be conducted within a country to examine loneliness in subcultures and minority groups (Van Staden & Coetzee, 2010). In future studies, researchers should examine whether there are differences in loneliness across ontogeny as a function of culture, which means that they need to establish the cultural equivalence of child, adolescent, and adult loneliness measures.

## *Concluding Remarks*

In sum, our review of the life-span literature indicates that, despite differences in the sources of loneliness across ontogeny, people of all ages are motivated to reconnect with others. Also, behavioral (e.g., social withdrawal) and cognitive (e.g., vigilance to social cues) reaffiliation processes are evident at different stages of development. This review further indicates that the RAM often goes awry and can lead to prolonged loneliness, for example, when the component processes of the system occur in combination with individual risk factors of loneliness, such as self-defeating attributions, low self-esteem, anxiety, certain personality traits, and certain genetic vulnerabilities. On the basis of these conclusions, we have proposed specific loneliness interventions for different developmental stages, and we have outlined avenues for future research. Given the harmful consequences of loneliness for physical and psychological health across the life span (J. T. Cacioppo & Hawkley, 2010; S. Cacioppo et al., 2015; Holt-Lunstad et al., 2015, this issue; Van Dulmen, & Goossens, 2013), effective age-appropriate interventions for loneliness may yield large dividends across development.

### Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

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