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Review

Attachment Security Priming: A Meta-Analysis

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Abstract

Attachment security priming has important theoretical and practical implications. We review security priming theory and research and the recent concerns raised regarding priming. We then report the results of a meta-analysis of 120 studies (N = 18,949) across 97 published and unpublished articles (initial pool was 1,642 articles) investigating the affective, cognitive, and behavioral effects of security priming. A large overall positive effect size (d = .51, $p < .001$) was found across all affective, cognitive, and behavioral domains. The largest effect was found for affect-related outcomes (d =.62, $p < .001$), followed by behavioral (d = .44, $p < .001$), and cognitive (d = .45, $p < .001$). Trait attachment anxiety and avoidance moderated the effects of subliminal security priming for behavioral outcomes—security priming effects were larger among people higher on attachment anxiety and avoidance. Assessment of publication bias revealed mixed evidence for the possible presence of asymmetry.

Keywords

attachment, security, priming, meta-analysis

Attachment security priming—experimentally enhancing one's sense of love, comfort, and safety—has been investigated since the early 1990s (Baldwin et al., 1993). For the last three decades, studies have examined the effects of security priming across various affective, cognitive, and behavioral outcomes and employed different priming methods to invoke a sense of security (Gillath & Karantzas, 2019; Mikulincer & Shaver, 2007). Many of these studies have demonstrated that security priming yields beneficial outcomes, such as enhanced emotional well-being (McGuire et al., 2018) and prosocial behavior (Mikulincer et al., 2005). However, some studies have demonstrated weak or mixed effects for security priming (e.g., Peterson, 2014; Pierce & Lydon, 1998), while other studies have found no significant effects (e.g., Gokce & Harma, 2018). These contradictory findings make it difficult to determine the effectiveness of security priming. Moreover, in light of the criticisms leveled at priming methodology in social psychology (Doyen et al., 2012; Newell & Shanks, 2014; Pashler et al., 2012, for debates on this issue) and attachment security priming specifically (Sakaluk, 2014), it is both necessary and timely that research into security priming be systematically synthesized to provide a coherent and comprehensive state of the field.

In the current article, we answer questions such as, "Is security priming associated with positive outcomes, and if so, what is the magnitude of this association?"; "Which priming methods and stimuli are more effective at enhancing attachment security (e.g., subliminal or supraliminal procedures, stimuli in the form of words or images)?"; "Does security priming yield effect sizes of larger magnitude for some outcome variables over others (e.g., affective, cognitive, or behavioral)?"; "How long do security priming effects last? (Is priming effective only in the 'here and now'?)"; and finally, "Do attachment styles (i.e., trait levels of attachment security and insecurity) moderate the effects of security priming?" Answering these questions can provide important insight into the field of attachment security priming and a clear understanding of the effectiveness of contextually manipulating felt security.

Attachment Theory and Research

Attachment theory emphasizes the emotional bonds that people form with significant others, beginning in infancy with one's primary caregiver and continuing throughout the lifespan (Bowlby, 1982; for reviews, see Cassidy & Shaver, 2016; Gillath et al., 2016). According to attachment theory (e.g., Bowlby, 1982), people are equipped with a behavioral attachment system. In times of threat and distress, the attachment

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system is activated, motivating people to seek proximity to stronger, wiser others, termed *attachment figures*, to receive care and support and regain a sense of security. If attachment figures provide sensitive and responsive care and support, people are likely to feel safe and secure; the attachment system is deactivated, and people can engage in other life tasks and activities. This sense of security also allows people to regulate their emotions better and cope with stressful and challenging situations (Mikulincer et al., 2003). Over time, people internalize these security-enhancing experiences and associated feelings in the form of positive mental representations of themselves and others and develop a secure *attachment style*. Attachment style is defined as a trait-like individual difference—capturing how people think, feel, and behave in close relationships (Gillath et al., 2016; Mikulincer & Shaver, 2016).

However, not all experiences with attachment figures meet people's needs for love, comfort, and security. Ainsworth and colleagues (1978), who studied the early development of individual differences in attachment, have classified infants into three patterns of attachment based on the infants' interactions with their caregivers: secure, avoidant, and anxious. The provision of sensitive and supportive care by an attachment figure is thought to result in a secure attachment pattern. Cold, rejecting, and insensitive care is thought to result in an avoidant insecure attachment pattern. Finally, inconsistent and intrusive care is thought to result in an anxious, insecure attachment pattern. Hazan and Shaver (1987) extended Bowlby's theory and Ainsworth et al.'s attachment pattern categorization into the domain of adult romantic relationships by investigating adults' attachment styles. Since their seminal paper, hundreds of studies have investigated adult attachment styles and found them predictive of various psychological, behavioral, and physiological/neurological processes and outcomes (for reviews Cassidy & Shaver, 2016; Gillath et al., 2016; Mikulincer & Shaver, 2016).

Although initial conceptualizations and assessments of attachment styles in adulthood were categorical (e.g., Bartholomew & Horowitz, 1991; Hazan & Shaver, 1987), the current common view within the personality and social psychology tradition conceptualizes and assesses attachment styles as dimensions. The preference for taking a dimensional approach redresses a number of the limitations of categorical approaches to attachment style conceptualization and measurement: (1) categorical measures assume that attachment styles are mutually exclusive, (2) within-group variability is considered trivial, and (3) attachment classifications demonstrate high instability over time (Fraley & Waller, 1998; Gillath et al., 2016; Karantzas et al., 2010; Mikulincer & Shaver, 2016). Both theory and research aimed at addressing these limitations suggest that attachment styles are best situated within a two-dimensional space (Brennan et al., 1998; Fraley & Waller, 1998; Gillath et al., 2016). The two dimensions are termed attachment anxiety and avoidance. People high on anxiety are characterized by excessive fear of being rejected or abandoned and difficulties regulating one's emotions. Conversely, people high on avoidance are characterized by discomfort with closeness and a reluctance to trust and depend on others or to have others depend on them.

Attachment security, which is the focus of the current paper, is the sense that one is worthy of love and that others will be there for them in times of need. Secure individuals tend to score low on both attachment anxiety and attachment avoidance (Brennan et al., 1998; Gillath et al., 2016). Attachment security is correlated with various positive personal and interpersonal outcomes. For example, it is associated with effective emotion regulation, well-being, relational stability, relationship satisfaction, and harboring prosocial attitudes (e.g., Gillath et al., 2008; Gillath & Karantzas, 2019; for a review, see Gillath et al., 2016, ch. 7).

Attachment security is also associated with high self-esteem and positive mood (e.g., Hart et al., 2005) and is characterized by various pro-relational behaviors. In terms of relationship behaviors, secure people are more trusting and forgiving of others compared with insecure people (e.g., Hazan & Shaver, 1987; Lawler-Row et al., 2006; Mikulincer et al., 2006) and provide help and support to others in need (N. L. Collins & Feeney, 2000; Gillath et al., 2005). Because of the positive qualities and outcomes related to attachment security, researchers, clinicians, and society at large are highly interested in finding ways to increase people's sense of security.

Attachment security increases when close others (e.g., parents, friends, or romantic partners) act as security providing figures and fulfill a person's attachment needs over time (Kumashiro & Arriaga, 2020). There are different ways through which attachment security can be simulated and enhanced. For example, clinicians use therapeutic approaches in which the therapist acts as a security-providing figure, thereby increasing one's sense of security while providing a model for future relationships (e.g., S. M. Johnson, 2002; Johnson, 2019). However, here we focus on experimental methods that can be used to enhance security, which has a long tradition in social psychology. In these methods, people are exposed to stimuli designed to activate a sense of love, comfort, and safety—a social cognitive procedure known as *attachment security priming* (Baldwin et al., 1993; see reviews Gillath et al., 2016; Gillath & Karantzas, 2019).

Priming

Priming is the activation of a particular mental representation or the strengthening of an association in one's memory network (Molden, 2014). Frequently, priming is conceptualized and tested through its effects on a subsequent action or task—the facilitative effects of an event or activity on a following associated response(s) (e.g., Tulving, 1983) or on the activation of stored knowledge (E. T. Higgins & Eitam, 2014). In this respect, priming is thought to increase responsiveness to particular stimuli. Priming can occur following a conscious or

an unconscious exposure to a cue (supraliminal or subliminal priming) and can operate at a pre-semantic level (i.e., before meaning is inferred; Tulving & Schacter, 1990). The effects of priming can range from cognitive and affective responses to the enactment of behaviors (Mikulincer & Shaver, 2007). The effects of repeated priming manipulations (exposing people to primes multiple times across consecutive sessions) have the potential to persist for more extended periods than is typically observed in brief lab studies (e.g., Gillath et al., 2008; Hudson & Fraley, 2018; McGuire et al., 2018).

Priming in Close Relationships and Attachment

Drawing on existing priming literature, researchers such as Baldwin (1994; Baldwin et al., 1993, 1996) used priming techniques to study constructs central to attachment-related cognitions, such as people's relational schemas (or internal working models). Baldwin et al. examined whether the application of priming to activate relational schemas related to attachment enhanced a person's sense of security (as well as their sense of attachment anxiety and avoidance). While activated, researchers can examine the effects of priming attachment (in)security on various outcomes of interest (e.g., cognitive, affective, and behavioral). Researchers can also examine whether people's chronic attachment styles moderate the effects of security priming on an outcome.

Researchers can prime a sense of attachment security in study participants due to their preexisting attachment security-related memories (Weingarten et al., 2016). Then, by way of "spreading activation" (A. M. Collins & Loftus, 1975), additional nodes within one's semantic network are triggered. Theoretically, this creates a sense of security similar to that induced by the presence of supportive others who provide love, comfort, and security (i.e., security-providing attachment figures).

Security priming allows researchers to overcome several methodological and research design issues associated with correlational or quasi-experimental research (e.g., Baldwin et al., 1996; Banse, 2003). First, security priming addresses issues of directionality and causality by employing experimental methods where participants are randomly assigned to conditions (e.g., security vs. neutral). It also allows researchers to control for possible known and unknown confounds, thus ruling out alternative explanations for particular relationship outcomes (e.g., the alternative that the effects of security are due to an increase in positive affect or self-esteem; Carnelley & Rowe, 2010).

Second, priming can help reduce social desirability bias, positive self-presentation bias, and the inability to access people's unconscious processes or bypass various cognitive defense mechanisms (especially those of people high on attachment avoidance). When people know what they are being assessed for, they are more likely to monitor their behavior and engage in self-presentation biases and respond in a socially desirable way. For example, self-report measures typically capture people's conscious cognitions, such as attitudes or evaluations regarding a particular phenomenon and are more susceptible to the abovementioned biases (Schwarz, 1999). In priming studies, participants (and experimenters) often do not know what is expected from them or what the study goals are. Because of that, priming studies are not as susceptible to demand characteristics or experimenter biases as some non-priming studies. Moreover, in subliminal priming studies, the stimulus is delivered at a level of awareness that bypasses conscious processing and is thus assumed to bypass some of the biases and defensive processes typical of insecurely attached individuals.

Third, priming studies are often not as labor-intensive and expensive as conducting interview-based and qualitative studies (which can suffer from similar biases as self-reports measures). Aside from the time and personnel costs involved in data collection and coding, studies using interviews often require researchers to undertake extensive training regarding interview procedures and the application of coding schemes (e.g., the AAI; Main et al., 2008). Thus, priming is relatively easier to administer (both in the laboratory and in the field) and can be a cost-effective and rapid method for conducting attachment research.

Despite all its advantages, priming is not without its limitations. In recent years, as a part of the replication crisis (Shrout & Rodgers, 2018), there has been an increase in criticisms leveled against priming in social psychology in general (e.g., Donnellan et al., 2015; Harris et al., 2013; Molden, 2014) as well as attachment security priming specifically (Sakaluk, 2014). Many of these general criticisms of the priming field focus on the inconsistent or mixed nature of priming findings (Shariff et al., 2016). Specifically, regarding attachment security priming studies, some studies find effects for security priming, whereas others find no such effects (Sakaluk, 2014). Furthermore, some studies find that the effects of security priming are moderated by attachment style, while other studies do not (T. J. Collins & Gillath, 2012; Mikulincer et al., 2005). Considering the inconsistent findings of past security priming research and the concerns voiced by Cesario (2014) regarding priming and replicability more generally, one can wonder if "any [security] priming effects are real?"

Other issues related to security priming are methodological, such as the diversity of methods used across studies to prime security. Given that most of these studies do not compare different security priming methods, researchers in the field are left at a loss as to whether inconsistencies are due to differences in the techniques used to prime security or due to the lack of effectiveness of security priming in general. The methodologies used by researchers differ on many levels: the stimulus or prime task utilized (e.g., words vs. images), the level of awareness at which the stimulus is administered (subliminal vs. supraliminal), and the particular comparison condition employed (e.g., neutral, positive affect, and insecure attachment). As a result of this methodological

diversity, scholars are unable to determine whether security priming methods can be used interchangeably to achieve a given effect size or whether some methods are more robust in terms of (a) the size of the effects produced and (b) the consistency of these effects. We discuss each of these methodological differences in the sections subsequently.

Another methodological criticism relates to the conduct of security priming studies with small sample sizes. This raises questions as to whether published studies are sufficiently powered to detect the effects reported. If priming effects are found across a large number of published studies, and if these studies are deemed underpowered, then the associations reported in the literature may reflect publication bias rather than reliable associations.

Payne and colleagues (2016) argue that the question of whether priming effects are real should be separated from questions surrounding methodological issues about the replicability of findings by way of specific experimental designs. Cesario (2014) adds that people should expect priming effects to be sensitive to variations in experimental features and samples and that people should come up with theories of what might moderate priming effects. It is, therefore, necessary for any quantitative synthesis of the field of security priming to (a) determine the overall consistency of findings, (b) identify potential moderators (such as the technique used for priming and the role of attachment style), and (c) thoroughly test for publication bias. Using meta-analysis to systematically evaluate the effect size of security priming and determine the robustness of priming effects, the current work can provide quantitative evidence that directly addresses critical issues in the field of security priming as well as shed light on the integrity of psychological research within this area (Asendorpf et al., 2013; Cumming, 2014; Cumming et al., 2012; Shariff et al., 2016).

Aspects of Security Priming

Given that security-priming research has been undertaken using various methodological approaches, we examine the extent to which different methodological components of security priming (e.g., the priming method used and the stimulus employed) moderate the effect of security priming. Specifically, we examined whether the type of stimuli (e.g., words vs. images), priming task (e.g., lexical decision or word search), the level of exposure (subliminal vs. supraliminal), and the control or comparison conditions used (e.g., neutral prime or positive affect prime), moderate the effects of security priming. Furthermore, given that a wide variety of outcomes have been assessed as a part of security priming research and that research spans both cross-sectional and longitudinal designs, we also examined whether the effects of security priming are moderated by the type of outcome (such as broad as well as specific cognitive, affective, or behavioral outcomes) and timeframe (i.e., whether people exposed to security priming at one point in time or subjected to repeated priming over time). We also investigated the time course of priming and whether the effects of security priming were moderated by attachment style. In the sections subsequently, we elaborate on the abovementioned factors and their potential role as moderators of the effects of security priming.

The Stimuli and Task Used for Security Priming

Attachment security can be primed with many different types of stimuli. For example, people can be exposed to security-related words (e.g., love, hug, affection, and support), names of security-providing attachment figures (e.g., the name of one's mother or romantic partner), or pictures (either general stimuli—representing attachment security, such as a mother hugging a child—or specific stimuli—such as pictures of one's romantic partner).

Exposure to attachment-related words or images can be done via different tasks. For example, McGuire and colleagues (2018) used a word search task, where half of the participants were exposed to security-related words like "love," 'hug,' and "safe." The other half were exposed to control non-attachment-related words such as "table," 'ball,' or "window" while completing the task. A different example is a task used by Gillath et al. (2010) in their study about attachment and authenticity—the computerized furniture task. In every trial of the task, participants were shown the names of two pieces of furniture at a time (e.g., lamp—rug or desk—chair) and were asked to indicate how similar they think the two pieces are to each other. Before each trial, participants were exposed to a security-related word (such as the ones mentioned above) on a computer screen followed by a visual mask and then asked to provide their similarity rating. In both examples mentioned above, researchers were not interested in the performance on either task; instead, the task was used to administer the priming.

Conversely, researchers use tasks, such as the dot-probe task (MacLeod et al., 1986), and the lexical decision task (Meyer & Schvaneveldt, 1971; Tulving & Schacter, 1990), where the priming is embeded in the task that is used to assess the outcome variable. In both of these tasks (dot-probe and lexical decision), participants are exposed to security-enhancing words or pictures and are then required to scan a visual field to detect the positioning of the word (whether the word is presented on the left or right of the screen center) or the nature of a given letter string whether the letter string is a proper English word or a non-word).

A different type of tasks used to prime security involves recalling or imagining a secure interaction or relationship. In such a recall task, participants are given time to recount memories of being loved and supported by attachment figures (*visualization*; e.g., Baldwin et al., 1996) and then asked to write about them. In imagining task, participants are asked to engage in a semi-structured *guided imagery* of a security-enhancing interaction/relationship with security providing close others and then write about it (Bartz & Lydon, 2004). We will examine the task type as a moderator, which will allow us to test

whether the priming tasks used across studies yield similar or dissimilar effects.

Although we have provided an overview of the different types of stimuli and tasks that can be employed as part of security priming, it is important to note that specific stimulus types are commonly paired with a particular type of task across many studies. For example, attachment-related words are often used in lexical decision-making tasks, whereas the names of attachment figures are often used as part of visualization and guided imagery tasks. This is important to highlight as stimulus and task represent methodological aspects of security priming that are often "yoked" due to study design. Thus, it is often impossible to disentangle the effects of stimulus type from the effects of task type. Considering this issue, we treat these two aspects of study design (i.e., stimulus and task) as a single moderator variable in our analyses.

Level of Awareness

People can be exposed to the priming stimuli (such as words or images) at different levels of awareness. For instance, they might be exposed to the stimuli for a very brief time, which reduces the period participants have to perceive what they are viewing consciously. Researchers often refer to this approach as *subliminal priming*. Alternatively, during visualization and guided imagery tasks, participants are aware of what they are exposed to - or are asked to do - and hence, researchers often refer to this as supraliminal priming. It is important to note that although priming does not necessitate a lack of awareness for the procedure itself to work (e.g., Cleeremans et al., 1998), it does require a lack of awareness regarding the expected effects of the prime on one's responses ("it is people's failure to recognize the possible implications of this exposure," that is necessary Molden, 2014, p. 5). Thus, priming effects are often described as "nonconscious" but not as "fully automatic."

Why should the level of exposure matter? One reason a researcher might be interested in the differences between subliminal and supraliminal security primes is the tendency for avoidantly attached people to suppress attachment-related information as a way of defending themselves from experiencing hurt (Rowe et al., 2020). When exposed to a supraliminal prime, avoidant individuals may try and suppress attending to or processing the prime, and by doing so, the effectiveness of the prime may be reduced for these individuals. When the prime is subliminal, it bypasses conscious awareness; thus, avoidant individuals are less likely to suppress the processing of the prime. Hence, subliminal security primes may be more effective (compared with supraliminal primes) for avoidant people. We will compare the effects of subliminal and supraliminal primes as part of our analyses.

The Outcomes of Security Priming

According to attachment theory (Ainsworth et al., 1978; Bowlby, 1982) and Mikulincer and Shaver's (2016) "Broaden and Build Cycle of Attachment Security," feeling secure increases people's resilience and improves their coping flexibility, skills, and capabilities. Feeling secure also facilitates emotion regulation (e.g., self-soothing). When threats abate, the assumption is that people can, and do, focus their attention on other behaviors.

Based on these theoretical assumptions, researchers (e.g., Canterberry & Gillath, 2012) have examined the effects of security priming on three major types of outcomes: (1) affective outcomes, such as increased positive affect, improved emotion-regulation, and reduced affective mental health issues such as depression and anxiety; (2) cognitive outcomes, such as higher accessibility of positive attitudes or change in attitudes (increase in positive attitudes, decrease in negative attitudes); and (3) behavioral outcomes, such as an increase in pro-social tendencies—demonstrating compassion and altruism (Mikulincer et al., 2005) or reacting positively to out-group members (Mikulincer & Shaver, 2001).

Some researchers (e.g., Gillath et al., 2009) have investigated whether security priming can augment a person's trait attachment style. The premise behind this work is that enhancing feelings of security should attenuate the chronic attachment-related worries and concerns of insecure individuals. However, given that attachment style is an aspect of individual difference that comprises cognitive, affective, and behavioral components, it is necessary to examine this outcome separately from exclusively cognitive, affective, or behavioral outcomes. To this end, as part of our meta-analysis, we estimated the effect sizes of security priming separately across affective, cognitive, and behavioral outcomes and attachment styles.

Interactions With Attachment Style

As noted earlier, attachment style has been treated as an outcome variable in some studies. In other studies, attachment style is treated as a moderator of the association between security priming and a given outcome. The primary reason extends upon the argument proposed by Cesario and Jonas (2014) that the effects of primes vary as a function of individual differences such as participant attitudes or characteristics (see also Gillath & Ai, 2021). In line with this argument, some researchers examine whether the effects of security priming differ for people with different attachment styles. On the one hand, it makes sense that security priming would have a larger effect on insecure people as compared with secure people. Security priming should temporarily attenuate the negative cognitive, affective, and behavioral characteristics of insecure individuals and may even enhance positive cognitive–affective and behavioral outcomes. In contrast, secure individuals may experience more minor differences in their cognitions, affect, and behavior post-exposure to the prime, as their preexisting chronic trait security affords them less room for change (see, for example, T. J. Collins & Gillath, 2012; Gokce & Harma, 2018).

Alternatively, the prime may be more effective among secure people because they have a larger bank of security-based knowledge and schemas than insecure individuals that can be activated by the prime (e.g., Mikulincer et al., 2009; Waters & Roisman, 2019). Furthermore, insecure individuals, especially those high on avoidance, harbor defense mechanisms that may suppress the processing of attachment-related stimuli and thereby reduce the impact of a security prime (see Mikulincer et al., 2009). Another possibility (derived from existing empirical literature) is that security priming will have the same effect on all individuals irrespective of their attachment style (Millings et al., 2019). Given that most people experience different relational interactions with family, romantic partners, and peers throughout their lives, even those who are chronically insecure are likely to have experienced some form of security-enhancing interactions that are stored in long-term memory and can be activated during priming (Gillath et al., 2008; Mikulincer & Shaver, 2016). The evidence concerning the role of attachment style is mixed (e.g., T. J. Collins & Gillath, 2012 vs. Mikulincer et al., 2005); thus, the question remains as to whether attachment style moderates the effects of security priming. We will investigate the moderating role of attachment style as part of our analyses.

Effects Over Time and Repeated Exposure

Wentura and Rothermund (2014) highlight the need to distinguish between priming that involves relatively short-term effects (lasting seconds) from priming effects of longer duration (lasting minutes or even days). According to Bowlby (1973), repeated interactions with an attachment figure not only alter attachment system functioning in the short term but also affect the consolidation of working models in the long term. Based on Bowlby's (1973) conceptualization, scholars have examined two aspects of security priming: *repeated* exposure to security priming and effects of security priming *over time* (e.g., Gillath et al., 2008). Repeated exposure can occur during one session (priming is repeatedly delivered as part of the same session or assessment phase) or over multiple sessions (e.g., twice a week for 3 weeks). Effects over time are assessed at a certain point after exposure to the prime, whether exposure to the prime was done as part of a single session or across multiple sessions. In line with Bowlby's theoretical assumptions, repeated priming is likely to have longer lasting effects across time.

A few empirical studies provide support for the idea that repeated security priming can yield lasting effects. For example, Dandeneau and colleagues (2007) primed students for five consecutive days during the final exam period. It was found that security priming over time attenuated stress, and the effects of priming persisted even after the students took their final exams at school. In a second field study, where telemarketers were primed for five consecutive days, Dandenau et al. found that participants in the security-priming group had higher self-esteem, decreased self-reported stress, lower cortisol levels (assessed from saliva), improved sales performance, and higher ratings by supervisors compared with control participants. Carnelley and Rowe (2007) found similar results following repeated security priming. Specifically, participants exposed to security priming over consecutive days had more positive expectations of relationship partners' behavior and more positive self-views than those exposed to a control prime two days post priming. Repeated security priming also decreased attachment anxiety among participants.

Gillath and colleagues (2008) reported similar results. They tested whether repeated security priming (every second day for two weeks) may result in benefits that persist for one week after the priming ends. They found that participants in the security priming condition reported higher scores on self-esteem, positive mood, and compassion toward others than participants in the control group. Finally, McGuire and colleagues (2018) showed that repeated security priming for two weeks (three times a week, every other weekday) decreased depression. Overall, the evidence to date provides initial support for the idea that the effects of security priming last over time, especially when repeated security priming is used. Given these findings, we will examine the effects of repeated security priming and security priming over time.

Control and Comparison Conditions

To test the effectiveness of security priming and address a plausible alternative hypothesis—that security priming is nothing more than an increase in positive affect or self-esteem—researchers have compared the effects of security priming with various other prime conditions. These alternative primes include (but are not limited to) different neutral or control primes (such as doing [or imagining doing] a mundane task on one's own [e.g., driving somewhere or running errands] or engaging in such tasks with an acquaintance or with one's partner), insecurity primes (e.g., asking participants to recall insecure relationships invoking attachment anxiety or avoidance), self-esteem boosts (e.g., providing positive feedback after a task), and positive affect primes (e.g., telling a joke or watching a funny movie clip). Using these prime types as comparison groups allows researchers to rule out alternative explanations for findings as they relate to security priming. For example, comparing security primes to neutral primes addresses the possibility that exposure to *any* prime (whether word or image) results in the same outcome. Comparing security primes with positive primes addresses the possibility that security effects are merely due to a change in positive affect or self-esteem boost rather than an actual increase in attachment security.

Current Study

The past three decades have seen an increase in the number of studies investigating attachment security priming. However,

the accompanying increase in the inconsistent findings reported across studies, along with the criticisms leveled at priming more generally, warrant a careful examination of the state of the field of security priming. Therefore, the current work aims to use meta-analysis to (1) determine the overall effect size of security priming and estimate the magnitude of the effect size across cognitive, affective, and behavioral outcomes; (2) determine whether the effect size differs across various methodological aspects of priming studies as well as across attachment styles; and (3) investigate the presence of publication bias.

Method

The search strategy and identification of articles for the meta-analysis were in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) and are outlined in Figure 1. As part of the initial identification of studies, a series of electronic databases were used to conduct literature searches, including PsycINFO, PsycARTICLES, PsycBOOKS, Psychology and Behavioral Sciences Collection, CINAL, Medline, Academic Search Complete, ProQuest, Web of Science, and Scopus (January 1994–March 2019). A variety of keywords were used separately and in combination to search titles, abstracts, and the full content fields of each database. These keywords included: *attachment* AND (*priming* OR *prim**), AND (*security* OR *secur**). Specific author names known to conduct work in security priming were also included in the search, *Mikulincer*, AND *Shaver*, AND (*Gillath* OR *Carnelley OR Rowe*). Additional records were identified by examining the reference lists of articles recovered through the databases search to capture any relevant studies that may have been missed using the search strategy listed earlier. A call for unpublished studies on security priming was posted on the listservs as well as the online newsletters and bulletins of the International Association for Relationship Research, the Society for Personality and Social Psychology, and the Society for Experimental Social Psychology. We also directly contacted authors for whom we were aware had recently completed security priming studies.

As part of the screening and eligibility stages, article abstracts were examined against the inclusion criteria outlined in Figure 1. Specifically, the criteria included:

1. The study was written in English.
2. The study sample consisted of adults (18+ years as the focus was on the effects of security priming in adulthood).
3. Effects of security priming were the focus of the study (as opposed to insecurity priming, as our aim focused on determining the effects of priming a sense of attachment security).
4. The study assessed the direct association between security priming and any outcome variable(s).
5. The study reported summary data for the calculation of effect sizes (e.g., correlations, group means, standard deviations, and sample sizes).

The number of excluded articles was noted and tabulated against reasons for exclusion (see Figure 1). Articles deemed eligible were retrieved for full-text review and screened independently by two of the co-authors (KK and DR), and those deemed as not meeting the inclusion criteria after full-text review were excluded (see Figure 1). The intraclass correlation (ICC) of the raters was .97. This was followed by data extraction and a second round of screening with a focus on the reliable coding of moderators (i.e., priming methodology, priming stimulus, comparison group, outcome variables, and attachment style). This coding was also undertaken independently by two co-authors (DR and GK) and resulted in an ICC of .90. Any discrepancies were resolved through discussion involving three of the authors (OG, GK, and DR), with a consensus reached in all cases in which discrepant coding was identified. After this second round of coding, the final number of peer-reviewed publications were subjected to quantitative synthesis (data files can be found at https://osf.io/xbcsr/?view_only=882f223e410f406584a8c4a4ca1b6417).

Data Analysis

The effect sizes in the form of summary statistics reported across studies were sourced (i.e., correlations and mean differences) and converted into a common effect size metric—in this instance—standardized mean difference (*d*), which represents the size of the effect in each study relative to the variability observed in that study (Borenstein et al., 2009). Data extraction estimation of *d* was limited to summary statistics to obtain the most direct approximation of the effect size (Lipsey & Wilson, 2001). Ninety-five percent confidence intervals (CI 95%) were calculated for all effect sizes using a random-effects model to determine if *d*s significantly differed from zero. For studies that assessed the effects of security priming over time, the association between security priming and outcomes reported at any point in time were averaged to determine the mean change in the study outcome variable over time. According to Cohen's (1988) rules of thumb, $d < .2$ is regarded as a small effect size, between .2 and .5 as a moderate effect size, and a $d > .5$ as a large effect size. Given the large variability in the number of studies included as part of different moderator analyses, the heterogeneity of effect sizes was estimated using I^2 (J. P. T. Higgins & Thompson, 2002). The I^2 represents the proportion of variance due to between-study differences, with values ranging from 0% to 100%, with higher values indicative of greater heterogeneity (J. P. T. Higgins et al., 2003).

Analyses were undertaken using Comprehensive Meta-Analysis (CMA) version 3.0 software (Biostat Inc., Englewood, NJ). Given that numerous studies included

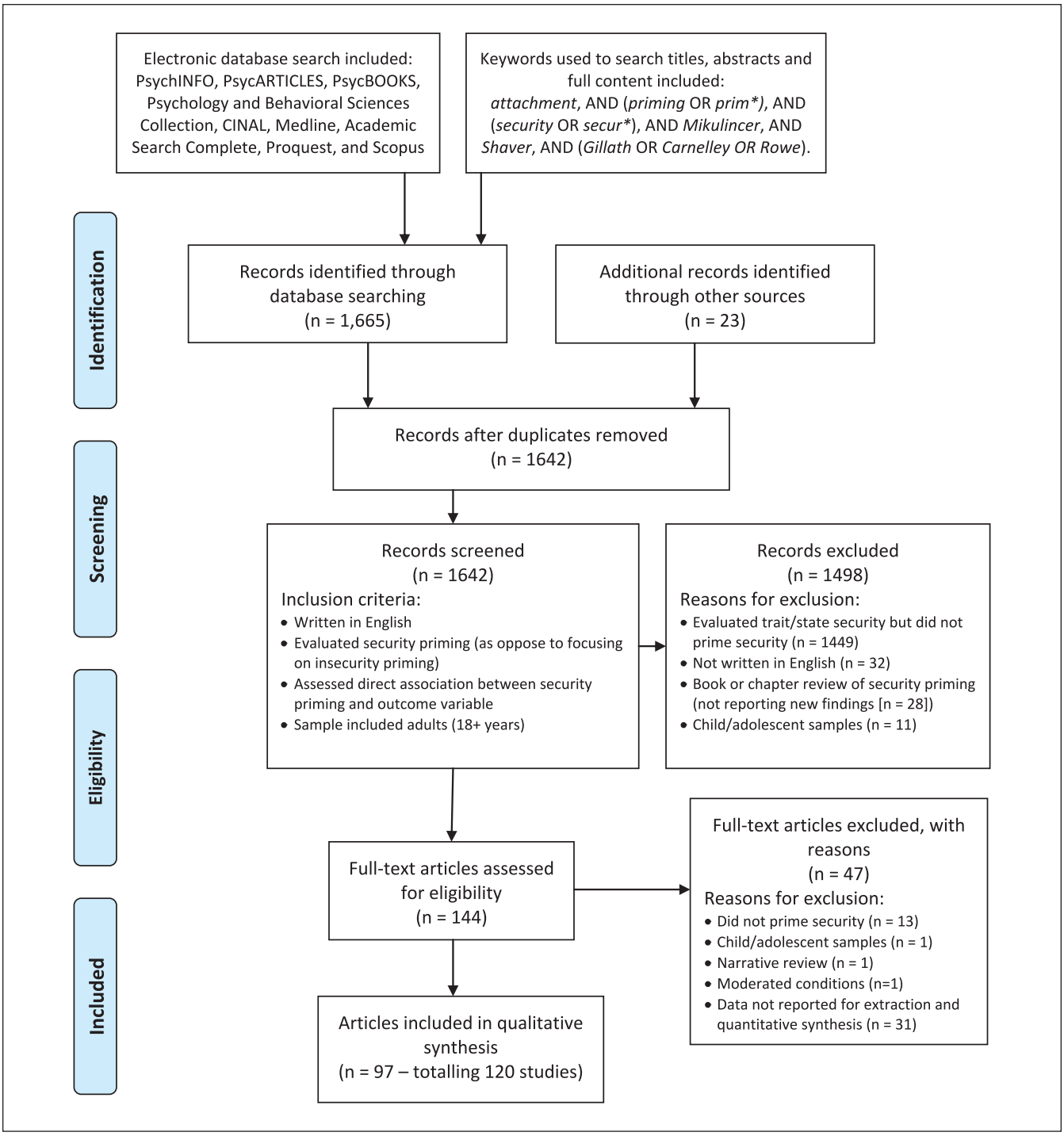


Figure 1. A flow diagram detailing the application of PRISMA to the quantitative synthesis of published security priming studies conducted between January 2016 and March 2019.
Note. PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

multiple outcomes, the unit of analysis was set at the study level in CMA, and the within-cluster correlation was set at $\rho = 1.0$, thus providing the most conservative estimate of variance for each study. These modeled assumptions address the issue of statistical dependency (i.e., clustering) that can emerge when multiple effect sizes require extraction from a given study (Borenstein et al., 2009).

The analyses were conducted in two stages. In the first stage, the overall effect of security priming was estimated using a random-effects model. In the second stage, a series of

subgroup analyses were undertaken to determine the extent to which the effect of security priming varied as a function of priming stimuli/task, level of prime awareness (i.e., subliminal, supraliminal), comparison condition, outcome type, and attachment style. Q-tests and z-tests were conducted to enable statistical comparisons across subgroups. A Q-test was initially conducted to determine whether the omnibus test demonstrated evidence of differences between subgroups. In instances when these subgroups involved more than two groups, z-tests were conducted to determine between which groups the significant differences in effect sizes were found.

Differences in security priming: Examination of methodological aspects of studies. We coded each study across different methodological aspects (see the introduction for a review). Specifically, our coding of studies was to determine whether the effects of security priming differed for various design features of the studies, outcome variable type, and attachment style. As shown in Table 1, we coded for *level of awareness* by categorizing studies as either subliminal (nonconscious exposure to security prime) or supraliminal (people asked to attend and process security-enhancing stimuli consciously or to view security-enhancing words or images consciously). For *prime task/stimuli*, studies were classified into four major categories: tasks involving the viewing of words (e.g., love, comfort), tasks involving the viewing of images (e.g., Madonna and child), tasks entailing the recall or noting down the names of attachment figures and close others, and guided imagery/visualization (e.g., recall an interaction in which one is made to feel loved and comforted). We grouped guided imaged and visualization tasks together because both tasks pertain to focusing on imagery, with guided imagery being more structured in procedure than visualization.

We also classified studies in terms of the *comparison condition* used to evaluate the effects of security priming. The different types of comparison conditions used across studies are listed in Table 1. Some of the most common comparison conditions included a control/neutral condition, an affect/mood prime condition (either positive or negative), an acquaintance condition (exposure to a familiar individual or close other who is not regarded as an attachment figure), and an insecurity prime (i.e., primed to experience attachment anxiety, avoidance, or a general sense of attachment insecurity).

Differences in security priming: The role of attachment style. Given that studies primed attachment security in all participants irrespective of their attachment style, we also examined whether *attachment style* moderated the effects of security priming. Studies differed in the way attachment style was assessed. Some studies focused on dimensional assessments (either two-dimensional assessments including attachment anxiety and avoidance or three-dimensional assessments including attachment security, anxiety, and avoidance). Other studies used categorical assessments entailing either three (secure, anxious, avoidant) or four (secure, dismissing, preoccupied, and fearful) attachment styles. To organize the coding of attachment style, we coded categorical and dimensional assessments under the same style providing that the assessments aligned conceptually. For instance, categorical and dimensional assessments that measured anxious attachment (or preoccupied attachment) were all coded as attachment anxiety (likewise for avoidant attachment [or dismissing attachment] and secure attachment). Studies assessing the fearful attachment category were coded as a separate category as this style is reflective of both high attachment anxiety and avoidance.

Differences in security priming by outcome type. Given that the effects of security priming have been most commonly investigated in relation to various *cognitive, affective, and behavioral outcomes*, we examined whether the effect of priming differed by outcome type in terms of these three broad categories of outcomes as well as specific outcomes that were grouped within each of these broad categories (see Table 2). We defined cognitive outcomes as any outcome where the primary focus was on cognitions (e.g., thoughts, attitudes, and memories). The specific cognitive outcomes examined are listed in Table 2. We defined affective outcomes as any outcome that reflected discrete affect or mood as well as emotional well-being. The specific outcomes that fell under this outcome category are listed in Table 2. We defined behavioral outcomes as variables that reflect some behavioral response or commitment toward a behavioral act, such as providing help to another or agreeing to help another in need. The specific behavioral outcomes that were examined as part of this broad category are listed in Table 2.

Furthermore, given that some studies examined attachment style as an outcome variable rather than a moderator (e.g., security priming was investigated as reducing trait attachment anxiety and avoidance), we also examined attachment style as an outcome variable. Importantly, because attachment style represents an individual difference variable that has cognitive, affective, and behavioral components, we investigated attachment style separately as an outcome variable rather than nested under multiple broad categories. Although not common, there were a small number of studies that focused on physiological outcome variables such as cortisol levels and respiration rate. Thus, we also investigated the effect of security priming on physiological outcomes.

Finally, we coded studies for whether studies primed attachment security on a single occasion or primed security on multiple occasions as part of longitudinal studies (either as a pre-post design or as multiple assessments over time). For longitudinal studies where the effects of priming were reported on more than two occasions, we estimated the effect of the prime for each occasion and then aggregated across

Table 1. Study Characteristics and Effect Size.

Author	Location	*N*	Age	Study setting	Level of awareness	Prime task/stimuli	Prime comparison	Outcome category	Specific outcome	*d*
Baldwin et al. (1996) Study 3	Canada	48	Median = 19	Lab	Supraliminal	Guided imagery	Anxious	Affective	Attraction to anxious partner	0.30
								Affective	Attraction to avoidant partner	−0.29
								Affective	Attraction to secure partner	0.10
		53			Supraliminal	Guided imagery	Avoidance	Affective	Attraction to anxious partner	0.57
								Affective	Attraction to avoidant partner	−0.32
								Affective	Attraction to secure partner	0.43
Baldwin (1994) Study 1	Canada	33	Mean = 21.61	Lab	Subliminal	Name	Critical SO	Cognitive	Appearance	0.50
								Cognitive	Performance	0.46
								Cognitive	Self-esteem	0.83
								Cognitive	Social acceptance	0.82
Baldwin (1994) Study 2	Canada	28	Mean = 23.68	Lab	Supraliminal	Name	Critical (mirror)	Affective	Arousal emotions	−0.49
								Affective	Positive affect	0.70
								Cognitive	Appearance	0.37
								Cognitive	Performance	0.56
								Cognitive	Self-esteem	0.59
								Cognitive	Social acceptance	0.65
		29			Supraliminal	Name	Critical SO	Affective	Arousal emotions	0.85
								Affective	Positive affect	−0.51
								Cognitive	Appearance	−0.06
								Cognitive	Performance	−0.45
								Cognitive	Self-esteem	−0.47
								Cognitive	Social acceptance	−0.38
Bale (2014) Study 3	Australia	151	Mean = 49.99	Online	Supraliminal	Visualization	Neutral	Affective	Distress reduction	1.67
								Behavioral	Provision of safe haven support	0.39
								Behavioral	Provision of secure-base availability	0.80
								Behavioral	Secure-base encouragement	2.14
								Behavioral	Secure-base interference	−1.96
								Cognitive	Self-esteem	0.41
Bale (2014) Study 4	Australia	180	Mean = 54.82	Online	Supraliminal	Visualization	Neutral	Behavioral	Receipt of secure-base encouragement	0.32
								Behavioral	Receipt of secure-base availability	−0.30
								Behavioral	Receipt of secure-base interference	0.65

(continued)

Table 1. (continued)

Author	Location	*N*	Age	Study setting	Level of awareness	Prime task/stimuli	Prime comparison	Outcome category	Specific outcome	*d*
								Behavioral	Receipt of safe-haven support	−0.12
								Affective	Distress reduction	0.61
								Cognitive	Self-esteem	−0.32
								Cognitive	Personal growth	0.82
Bartels & Zeki (2004)	United Kingdom	40	Mean = 34	Lab	Supraliminal	Image	Adult acquaintance	Affective	Admiration/respect	1.33
								Affective	Arousal/eroticism	0.00
								Affective	Dislike/contempt	0.57
								Affective	Friendship	2.22
								Affective	Indifference	1.16
								Affective	Love	2.10
								Affective	Tender/sentimental feelings	1.85
								Affective	Wanting to protect	1.18
		40			Supraliminal	Image	Child acquaintance	Affective	Admiration/respect	1.19
								Affective	Arousal/eroticism	0.45
								Affective	Dislike/contempt	0.59
								Affective	Friendship	0.50
								Affective	Indifference	0.73
								Affective	Love	2.11
								Affective	Tender/sentimental feelings	2.33
								Affective	Wanting to protect	1.20
		40			Supraliminal	Image	Unknown child	Affective	Admiration/respect	1.93
								Affective	Arousal/eroticism	0.45
								Affective	Dislike/contempt	0.00
								Affective	Friendship	1.28
								Affective	Indifference	1.42
								Affective	Love	2.83
								Affective	Tender/sentimental feelings	3.51
								Affective	Wanting to protect	1.91
		40			Supraliminal	Image	Unknown person	Affective	Admiration/respect	2.04
								Affective	Arousal/eroticism	0.00
								Affective	Dislike/contempt	−0.47
								Affective	Friendship	4.18
								Affective	Indifference	1.49
								Affective	Love	3.05

(continued)

Table 1. (continued)

Author	Location	*N*	Age	Study setting	Level of awareness	Prime task/stimuli	Prime comparison	Outcome category	Specific outcome	*d*
								Affective	Tender/sentimental feelings	2.55
								Affective	Wanting to protect	1.38
Bartz & Lydon (2004) Study 1	Canada	166	Mean = 22.01	Field	Supraliminal	Guided imagery	Anxious	Cognitive	Agency	0.41
								Cognitive	Communal orientation	0.40
		169			Supraliminal	Guided imagery	Avoidance	Cognitive	Agency	−0.02
								Cognitive	Communal orientation	0.30
Bartz & Lydon (2004) Study 2	Canada	63	Mean = 19.9	Lab	Supraliminal	Guided imagery	Anxious	Cognitive	Agency (men)	0.00
								Cognitive	Agency (women)	0.44
								Cognitive	Communal orientation (women)	0.42
								Cognitive	Communal orientation (men)	0.04
		63			Supraliminal	Guided imagery	Avoidant-dismissive	Cognitive	Agency (men)	0.27
								Cognitive	Agency (women)	0.40
								Cognitive	Communal orientation (men)	0.73
								Cognitive	Communal orientation (women)	−0.31
		59			Supraliminal	Guided imagery	Avoidant-fearful	Cognitive	Agency (men)	−0.19
								Cognitive	Agency (women)	0.73
								Cognitive	Communal orientation (men)	0.59
								Cognitive	Communal orientation (women)	0.00
Beauregard et al. (2009)	Canada	34	Mean = 36	Lab	Subliminal	Image	Control	Affective	Love	1.80
Boag & Carnelley (2016) Study 1	United Kingdom	124	Mean = 24	Online	Supraliminal	Visualization	Neutral	Affective	Empathy	1.42
								Affective	Felt security	1.77
								Cognitive	Prejudice	0.37
Boag & Carnelley (2016) Study 2	United Kingdom	56	Mean = 23.9	Online	Supraliminal	Visualization	Anxious	Affective	Distress	2.18
								Cognitive	Empathy	0.90
								Cognitive	Perspective taking	0.94
								Cognitive	Prejudice	−0.11
								Cognitive	Social dominance orientation	−0.32
		59			Supraliminal	Visualization	Avoidance	Affective	Distress	0.05
								Cognitive	Empathy	2.58
								Cognitive	Perspective-taking	2.90
								Cognitive	Prejudice	1.17
Bosmans et al. (2014)	Belgium	251	Mean = 19.08	Lab	Supraliminal	Visualization (parent)	Insecurity	Affective	Attachment security (t2-t1)	−0.02

(continued)

Table 1. (continued)

Author	Location	*N*	Age	Study setting	Level of awareness	Prime task/stimuli	Prime comparison	Outcome category	Specific outcome	*d*
						Visualization (partner)			Attachment security (t2-t1)	0.22
						Visualization (parent)		Cog/Aff/Beh	Attachment anxiety (t2-t1)	−0.07
						Visualization (partner)			Attachment anxiety (t2-t1)	−0.29
						Visualization (parent)			Attachment avoidance (t2-t1)	−0.31
						Visualization (partner)			Attachment avoidance (t2-t1)	0.28
						Visualization		Affective	Negative affect (t2-t1)	−0.02
						Visualization			Positive affect (t2-t1)	0.03
						Visualization (parent)	Neutral	Affective	Attachment security (t2-t1)	0.23
						Visualization (partner)			Attachment security (t2-t1)	0.11
						Visualization (parent)			Attachment anxiety (t2-t1)	−0.07
						Visualization (partner)			Attachment anxiety (t2-t1)	0.23
						Visualization (parent)			Attachment avoidance (t2-t1)	−0.34
						Visualization (partner)			Attachment avoidance (t2-t1)	−0.05
						Visualization			Negative affect (t2-t1)	0.01
						Visualization			Positive affect (t2-t1)	0.07
								Cognitive	Social dominance orientation	1.55
Carnelley et al. (2016) Study 1	United Kingdom	73	Mean = 20.1	Online/ Lab	Supraliminal	Visualization	Anxious	Affective	Anxiety	1.19
								Affective	Depression	1.28
								Affective	Felt security	1.82
		71			Supraliminal	Visualization	Avoidance	Affective	Anxiety	0.81
								Affective	Depression	0.52
								Affective	Felt security	2.26
		76			Supraliminal	Visualization	Neutral	Affective	Anxiety	0.35
								Affective	Depression	0.03
								Affective	Felt security	1.64

(continued)

Table 1. (continued)

Author	Location	*N*	Age	Study setting	Level of awareness	Prime task/stimuli	Prime comparison	Outcome category	Specific outcome	*d*
Carnelley et al. (2016) Study 2	United Kingdom	81	Mean = 20.32	Online/ Lab	Supraliminal	Visualization	Neutral	Affective	Anxiety	0.73
								Affective	Depression	0.01
								Affective	Felt security	2.34
Carnelley et al. (2018)	United Kingdom	48	Mean = 50.9	Field	Supraliminal	Visualization	Neutral	Affective	Anxiety	0.41
								Affective	Depression	0.50
		48			Supraliminal	Visualization	Neutral	Affective	Felt security	0.81
Cassidy et al. (2009)	United States	70	Median = 19	Lab	Subliminal	Word	Neutral	Affective	Appraised severity (how hurt)	0.32
								Affective	Negative affect	0.02
								Affective	Positive affect	−0.22
								Affective	Rejection feelings	0.14
								Behavioral	Constructive coping	−0.02
								Behavioral	Crying	0.02
								Behavioral	Defensive/hostile coping	0.22
Cassidy et al. (2018) Study 1	United States	153	Mean = 19.5	Online/ Lab	Supraliminal	Visualization	Neutral	Behavioral	Caregiving anxiety	0.22
								Behavioral	Caregiving avoidance	0.35
								Cognitive	Empathy	0.39
Cassidy et al. (2018) Study 2	United States	154	Mean = 19.8	Online/ Lab	Supraliminal	Visualization	Neutral	Affective	Caregiving anxiety	−0.02
								Behavioral	Caregiving avoidance	0.02
								Cognitive	Empathy	0.12
Jackson et al. (2019)	United Kingdom	70	Mean = 30.29	Online	Supraliminal	Guided imagery	Neutral	Affective	Felt security	1.41
								Behavioral	Interpersonal problem-solving	0.91
								Cognitive/ Behavioral	Effective solutions	1.16
								Cognitive/ Behavioral	Effective solutions (personal problems)	0.62
Charles-sire et al. (2012)	France	2364	Mean = 20.5	Field	Supraliminal	Word	Donating	Behavioral	Compliance	0.08
		2414			Supraliminal	Word	Donating	Behavioral	Verbal compliance	0.16
		2388			Supraliminal	Word	Neutral	Behavioral	Compliance	0.12
		3583			Supraliminal	Word	Neutral	Behavioral	Verbal compliance	0.24
Chugh et al. (2014) Study 1	United States	56	Mean = 21.8	Online	Supraliminal	Visualization	Anxious	Cognitive	Academic lying	0.27

(continued)

Table 1. (continued)

Author	Location	*N*	Age	Study setting	Level of awareness	Prime task/stimuli	Prime comparison	Outcome category	Specific outcome	*d*
Chugh et al. (2014) Study 2	United States	101	Mean = 20.93	Online	Supraliminal	Guided imagery	Anxious	Behavioral	Willingness to steal	0.42
Chugh et al. (2014) Study 3	United States	315	Mean = 33	Online	Supraliminal	Guided imagery	Anxious	Behavioral	Willingness to steal	0.28
Dandeneau et al. (2007) Study 2a	Canada	25	Not reported	Online/ Lab	Subliminal	Visual probe task	Control	Cognitive	Self-esteem	0.83
		23			Subliminal	Visual probe task	Control	Physiological	Cortisol levels	−0.61
Dandeneau et al. (2007) Study 2b	Canada	147	Not reported	Online/ Lab	Subliminal	Visual probe task	Control	Cognitive	Rejection bias (high self-esteem)	0.25
								Cognitive	Left visual field rejection bias (high self-esteem)	0.32
		147			Subliminal	Visual probe task	Negative affect	Cognitive	Left visual field rejection bias (low self-esteem)	−0.60
								Cognitive	Rejection bias (low self-esteem)	−0.59
Dandeneau et al. (2007) Study 3a	Canada	25	Not reported	Online	Subliminal	Visual probe task	Control	Affective	Anxiety	1.08
Dandeneau et al. (2007) Study 3b	Canada	23	Not reported	Online/ Lab	Subliminal	Visual probe task	Control	Physiological	Cortisol levels	−0.43
								Cognitive	Self-esteem	1.30
Dawson et al. (2015)	United States	64	Mean = 35.49	Lab	Supraliminal	Visualization	Neutral	Behavioral	Forthcomingness	0.32
								Cognitive	Honesty	0.34
								Cognitive	Perceptions of friendliness	−0.01
								Cognitive	Perceptions of trustworthiness	−0.11
Deng et al. (2016)	China	114	Mean = 20.26	Lab	Supraliminal	Guided imagery	Control	Affective	Felt security	1.89
								Cognitive	Highly optimistic explanatory style	−0.07
Dewitte & De Houwer (2011)	Belgium	47	Mean = 19.70	Lab	Supraliminal	Guided imagery	Anxious	Cognitive	Explicit evaluation att figure	1.40
								Cognitive	Inhibition negative words	0.67
								Cognitive	Inhibition positive words	0.18
		47			Supraliminal	Guided imagery	Avoidance	Cognitive	Explicit evaluation att figure	0.76
								Cognitive	Inhibition negative words	0.97

(continued)

Table 1. (continued)

Author	Location	*N*	Age	Study setting	Level of awareness	Prime task/stimuli	Prime comparison	Outcome category	Specific outcome	*d*
								Cognitive	Inhibition positive words	0.08
		47			Supraliminal	Guided imagery	Insecurity	Cognitive	Explicit evaluation att figure	1.11
								Cognitive	Inhibition negative words	1.11
								Cognitive	Inhibition positive words	0.08
Gillath & Hart (2010) Study 1	United States	72	Median = 19	Lab	Supraliminal	Guided imagery	Acquaintance	Cognitive	Charismatic candidate	0.62
								Cognitive	Goal-oriented candidate	−0.05
								Cognitive	Relationship-oriented candidate	0.35
		85			Supraliminal	Guided imagery	Close other	Cognitive	Charismatic candidate	0.60
								Cognitive	Goal-oriented candidate	0.08
								Cognitive	Relationship-oriented candidate	0.02
Gillath & Hart (2010) Study 2	United States	153	Median = 19	Lab	Supraliminal	Dental plan	Acquaintance	Cognitive	Support for war in Iraq	0.16
								Cognitive	Support for the war in North Korea	0.05
		153			Supraliminal	Mortality salience	Acquaintance	Cognitive	Support for the war in Iraq	5.53
								Cognitive	Support for the war in North Korea	4.89
Gillath & Shaver (2007)	United States	73	Median = 19	Lab	Supraliminal	Guided imagery	Unsupportive partner	Behavioral	Anxious partner choice	0.47
								Behavioral	Avoidant partner choice	0.98
								Behavioral	Secure partner choice	1.25
Gillath et al. (2006) Study 1	United States	48	Median = 23	Lab	Subliminal	Name	Acquaintance	Behavioral	Reaction time to self-disclose	0.55
								Behavioral	Willingness to self-disclose	0.63
		48			Subliminal	Name	Close other	Behavioral	Reaction time to self-disclose	0.58
								Behavioral	Willingness to self-disclose	0.64
Gillath et al. (2006) Study 2	United States	52	Median = 22	Lab	Subliminal	Name	Acquaintance	Behavioral	Seeking emotional support	0.53
								Behavioral	Seeking instrumental support	0.40
		52			Subliminal	Name	Close other	Behavioral	Seeking emotional support	0.33
								Behavioral	Seeking instrumental support	0.14
Gillath et al. (2010) Study 3	United States	57	Median = 19	Lab	Supraliminal	Lexical decision task	Neutral	Cognitive	State authenticity: bad qualities	1.05
								Cognitive	Authenticity: good qualities	1.09
		44			Supraliminal	Lexical decision task	Positive affect	Cognitive	Authenticity: bad qualities	1.19

(continued)

Table 1. (continued)

Author	Location	*N*	Age	Study setting	Level of awareness	Prime task/stimuli	Prime comparison	Outcome category	Specific outcome	*d*
								Cognitive	Authenticity: good qualities	1.13
Gillath et al. (2010) Study 4	United States	48	Median = 20	Lab	Supraliminal	Visualization	Neutral	Cognitive	Authenticity: bad qualities	0.59
								Cognitive	Authenticity: good qualities	1.03
Gillath et al. (2010) Study 5	United States	50	Median = 21	Field	Supraliminal	Visualization	Anxious	Behavioral	Lying: Academic setting	0.89
								Behavioral	Lying: Relationship setting	0.68
		48			Supraliminal	Visualization	Avoidance	Behavioral	Lying: Academic setting	0.36
								Behavioral	Lying: Relationship setting	0.71
Gillath et al. (2010) Study 6	United States	95	Median = 21	Lab	Supraliminal	Visualization	Neutral	Behavioral	Lying to partner	0.58
								Cognitive	Partner likeliness to lie	0.59
		91			Supraliminal	Visualization	Positive mood	Behavioral	Lying to partner	0.40
								Cognitive	Partner likeliness to lie	0.48
Gillath et al. (2010) Study 7	United States	47	Median = 19	Lab	Supraliminal	Visualization	Anxious	Behavioral	Cheating	0.36
		48			Supraliminal	Visualization	Avoidance	Behavioral	Cheating	0.90
		47			Supraliminal	Visualization	Neutral	Behavioral	Cheating	0.70
Gillath et al. (2017) Study 3	United States	80	Median = 21	Lab	Supraliminal	Visualization	Neutral	Behavioral	Dissolving ties	0.22
								Behavioral	Initiating ties	0.56
								Behavioral	Maintaining ties	0.24
Gokce & Harma (2018)	Turkey	84	Mean = 22	Lab	Subliminal	Word	Neutral	Cognitive	Reaction time (att.- words)	−0.04
								Cognitive	Reaction time (non-att)	0.02
Grau & Doll (2003) Study 3	Germany	89	Mean = 22	Field	Supraliminal	Visualization	Anxious	Cognitive	Equity in relationship	3.55
								Cognitive	Own contribution to relationship	0.54
								Cognitive	Own outcomes from relationship	5.92
								Cognitive	Partner's contribution to relationship	5.30
								Cognitive	Partner's outcomes from relationship	1.71
		87			Supraliminal	Visualization	Avoidance	Cognitive	Equity in relationship	−0.21
								Cognitive	Own contribution to relationship	2.61

(continued)

Table 1. (continued)

Author	Location	*N*	Age	Study setting	Level of awareness	Prime task/stimuli	Prime comparison	Outcome category	Specific outcome	*d*
								Cognitive	Own outcomes from relationship	3.48
								Cognitive	Partner's contribution to relationship	1.29
								Cognitive	Partner's outcomes from relationship	2.08
Herd (2015)	United States	40	Mean = 21.10	Online/ Lab	Supraliminal	Visualization	Neutral	Affective	Felt security	0.45
								Affective	Happiness	1.79
								Affective	Love	1.26
								Affective	Negative affect	0.09
								Affective	Positive affect	1.39
								Affective	Warmth	2.25
								Cog/Aff/Beh	Attachment anxiety	−0.20
								Cog/Aff/Beh	Attachment avoidance	0.46
								Cognitive	Closeness	1.23
								Cognitive	Psychopathy	−0.04
								Cognitive	Trust	1.53
		371			Supraliminal	Visualization	Time 1 secure prime	Cognitive	Psychopathy	−0.19
Homan et al. (2018) Study 1	United States	87	Mean = 20	Lab	Supraliminal	Visualization	Anxious	Cognitive	Body image	0.36
									Body image	0.16
Homan et al. (2018) Study 2	United States	102	Mean = 18.58	Lab	Supraliminal	Visualization	Anxious	Cognitive	Body appreciation (men)	0.18
		98			Supraliminal	Visualization	Anxious	Cognitive	Body appreciation (women)	0.24
		242			Supraliminal	Visualization	Neutral	Cognitive	Body appreciation	0.05
		102			Supraliminal	Visualization	Neutral	Cognitive	Body appreciation (men)	0.07
		98			Supraliminal	Visualization	Neutral	Cognitive	Body appreciation (women)	0.03
Hudson & Fraley (2018)	United States	88	Mean = 20.15	Online	Supraliminal	Visualization	Control	Affective	Negative affect	0.28
								Affective	Negative affect x time	0.06
								Affective	Positive affect	1.15
								Affective	Positive affect x time	−0.06
								Cog/Aff/Beh	Attachment anxiety	−0.26
								Cog/Aff/Beh	Attachment anxiety x time	0.16
								Cog/Aff/Beh	Attachment avoidance	−0.08

(continued)

Table 1. (continued)

Author	Location	*N*	Age	Study setting	Level of awareness	Prime task/stimuli	Prime comparison	Outcome category	Specific outcome	*d*
								Cog/Aff/Beh	Attachment avoidance x time	0.06
								Cognitive	Emotional stability	0.18
								Cognitive	Emotional stability x time	−0.02
								Cognitive	Life satisfaction	0.47
								Cognitive	Life satisfaction x time	0.02
Hutton et al. (2017)	United Kingdom	39	Mean = 21	Lab	Supraliminal	Guided imagery	Neutral	Affective	Depression	0.12
								Cog/Aff/Beh	Attachment anxiety	0.48
								Cog/Aff/Beh	Attachment avoidance	0.33
								Cognitive	Paranoia	−0.33
		39			Supraliminal	Guided imagery	Positive affect	Affective	Depression	−0.36
								Cog/Aff/Beh	Attachment anxiety	0.25
								Cog/Aff/Beh	Attachment avoidance	0.00
								Cognitive	Paranoia	−0.48
								Cognitive	Paranoia t2-t1	0.13
								Cog/Aff/Beh	Attachment avoidance t2-t1	−0.10
								Cog/Aff/Beh	Attachment anxiety t2-t1	−0.32
		39			Supraliminal	Guided imagery	Neutral	Cognitive	Paranoia t2-t1	0.39
								Cog/Aff/Beh	Attachment avoidance t2-t1	−0.18
								Cog/Aff/Beh	Attachment anxiety t2-t1	−0.19
Jarvinen & Paulus (2017)	United States	589	Mean = 32.16	Online	Supraliminal	Visualization	Anxious	Cognitive	Abortion openness	−0.16
								Cognitive	God openness	0.20
								Cognitive	Spending openness (on self-knowing of the poor)	0.09
								Cognitive	Trait openness	0.20
		597			Supraliminal	Visualization	Avoidance	Cognitive	Abortion openness	−0.10
								Cognitive	God openness	0.10
								Cognitive	Spending openness (on self-knowing of the poor)	−0.03
								Cognitive	Trait openness	−0.01
		640			Supraliminal	Visualization	Control	Cognitive	Abortion openness	−0.15
								Cognitive	God openness	0.11
								Cognitive	Spending openness (on self-knowing of the poor)	0.06
								Cognitive	Trait openness	0.04

(continued)

Table 1. (continued)

Author	Location	*N*	Age	Study setting	Level of awareness	Prime task/stimuli	Prime comparison	Outcome category	Specific outcome	*d*
Karremans & Aarts (2007) Study 1	Netherlands	45	Not reported	Lab	Subliminal	Name	Control	Cognitive	Inclination to forgive	0.75
		44			Subliminal	Name	Non-close other	Cognitive	Inclination to forgive	0.59
Karremans & Aarts (2007) Study 2	Netherlands	78	Not reported	Lab	Subliminal	Name	Non-close other	Cognitive	Inclination to forgive	1.02
								Cognitive	Severity of transgression	0.35
Karremans & Aarts (2007) Study 3	Netherlands	58	Not reported	Lab	Subliminal	Name	Non-close other	Affective	Attachment security	1.17
								Affective	Fearful attachment	1.35
								Cognitive	Forgiveness accessibility	0.69
								Cognitive	Liking	1.34
								Cognitive	Severity of transgression	0.28
Karremans et al. (2011)	Netherlands	30	Mean = 22	Lab	Supraliminal	Name	Neutral	Affective	Felt security	3.63
								Affective	Stress	0.84
Li et al. (2016) Study 2	China	51	Mean = 19.9	Lab	Subliminal	Stroop task (no depletion)	Acquaintance	Affective	Felt security	0.88
		63			Subliminal	Stroop task (depletion)	Acquaintance	Cognitive	Reaction time (colour-naming incongruent)	0.58
Liu et al. (2018) Study 2	China	135	Mean = 18.75	Online	Supraliminal	Guided imagery	Neutral	Affective	Felt security	1.11
Mallinckrodt et al. (2013) Study 1	United States	56	Mean = 21.88	Field	Supraliminal	Guided imagery	Positive affect	Affective	Negative affect	−0.48
								Affective	Negative affect (Mikulincer & Shaver)	−0.38
								Affective	Positive affect	0.06
								Affective	Positive affect (Mikulincer & Shaver)	0.03
								Cog/Aff	Cultural empathy	0.56
								Affective	Negative affect t2-t1	0.42
								Affective	Negative affect (Mikulincer & Shaver) t2-t1	0.18
								Affective	Positive affect t2-t1	−0.08

(continued)

Table 1. (continued)

Author	Location	*N*	Age	Study setting	Level of awareness	Prime task/stimuli	Prime comparison	Outcome category	Specific outcome	*d*
								Affective	Positive affect (Mikulincer & Shaver) t2-t1	−0.14
Mallinckrodt et al. (2013) Study 2	United States	53	Mean = 23.42	Field	Supraliminal	Guided imagery	Positive affect	Affective	Negative affect	−0.20
		53			Supraliminal	Guided imagery	Positive affect	Affective	Negative affect (Mikulincer & Shaver)	−0.26
								Affective	Positive affect	0.05
								Affective	Positive affect (Mikulincer & Shaver)	−0.18
		54			Supraliminal	Guided imagery	Positive affect	Cog/Aff	Cultural empathy	0.10
		53			Supraliminal	Guided imagery	Positive affect	Affective	Negative affect t2-t1	−0.05
								Affective	Negative affect (Mikulincer & Shaver) t2−t1	−0.12
								Affective	Positive affect t2−t1	0.26
								Affective	Positive affect (Mikulincer & Shaver) t2−t1	0.12
McGuire et al. (2018) Study 1	United States	125	Mean = 19.64	Lab/ Online	Subliminal	Word	Neutral	Affective	Depression	3.27
McGuire et al. (2018) Study 2	United States	69	Mean = 15.60	Lab	Subliminal	Word	Neutral	Affective	Depression	0.94
Mikulincer & Arad (1999) Study 2	Israel	50	Median = 23	Lab	Subliminal	Word	Avoidance	Cognitive	Number of recalled scenarios expectation congruent	0.06
								Cognitive	Change in perception of the partner expectation incongruent	1.32
								Cognitive	Change in perception of the partner expectation congruent	−0.09
								Cognitive	Change in perception of the partner expectation incongruent	0.83
		50			Subliminal	Word	Anxious	Cognitive	Number of recalled scenarios expectation congruent	−0.11

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Table 1. (continued)

Author	Location	*N*	Age	Study setting	Level of awareness	Prime task/stimuli	Prime comparison	Outcome category	Specific outcome	*d*
								Cognitive	Change in perception of the partner expectation incongruent	1.15
								Cognitive	Change in perception of the partner expectation congruent	−0.05
								Cognitive	Change in perception of the partner expectation incongruent	0.66
Mikulincer & Arad (1999) Study 3	Israel	50	Median = 23	Lab	Supraliminal	Visualization (expectation-congruent)	Control	Cognitive	Change in perception of the partner expectation congruent	−0.08
								Cognitive	Number of recalled scenarios expectation congruent	0.09
								Cognitive	Change in perception of the partner expectation incongruent	0.59
								Cognitive	Number of recalled scenarios expectation incongruent	0.72
Mikulincer & Shaver (2001) study 1	Israel	98	Median = 23	Lab	Subliminal	Word	Neutral	Cognitive	Evaluation of in-group target	−0.01
								Cognitive	Evaluation of out-group target	1.01
		98			Subliminal	Word	Positive affect	Cognitive	Evaluation of in-group target	0.15
								Cognitive	Evaluation of out-group target	0.88
Mikulincer & Shaver (2001) Study 2	Israel	40	Median = 23	Lab	Supraliminal	Guided imagery	Neutral	Behavioral	Willingness to interact with in-group	0.05
								Behavioral	Willingness to interact with out-group	1.10
		40			Supraliminal	Guided imagery	Positive affect	Behavioral	Willingness to interact with in-group	−0.02
								Behavioral	Willingness to interact with out-group	1.23
Mikulincer & Shaver (2001) Study 3	Israel	55	Median = 23	Lab	Supraliminal	Guided imagery	Neutral	Affective	Intergroup anxiety	0.72
								Cognitive	Evaluation of immigrants	0.70
								Cognitive	Realistic threat of immigrants	0.65

(continued)

Table 1. (continued)

Author	Location	*N*	Age	Study setting	Level of awareness	Prime task/stimuli	Prime comparison	Outcome category	Specific outcome	*d*
								Cognitive	Symbolic threat of immigrants	0.89
		55			Supraliminal	Guided imagery	Positive affect	Affective	Intergroup anxiety	0.99
								Cognitive	Evaluation of immigrants	0.63
								Cognitive	Realistic threat of immigrants	0.76
								Cognitive	Symbolic threat of immigrants	0.44
Mikulincer & Shaver (2001) Study 4	Israel	30	Median = 23	Lab	Subliminal	Word (failure feedback)	Neutral	Behavioral	Willingness to interact with in-group	0.07
								Behavioral	Willingness to interact with out-group	2.04
		30			Subliminal	Word (no feedback)	Neutral	Behavioral	Willingness to interact with in-group	0.19
								Behavioral	Willingness to interact with out-group	0.89
Mikulincer & Shaver (2001) Study 5	Israel	30	Median = 23	Lab	Supraliminal	Guided imagery (anti-Israeli)	Neutral	Cognitive	Evaluation of in-group target	0.64
								Cognitive	Evaluation of out-group target	1.53
		30			Supraliminal	Guided imagery (neutral)	Neutral	Cognitive	Evaluation of in-group target	−0.26
								Cognitive	Evaluation of out-group target	0.48
Mikulincer, Hirschberger, et al. (2001) Study 1	Israel	106	Median = 24	Lab	Subliminal	Image	Control	Cognitive	Liking rating of Chinese ideographs	0.59
								Cognitive	Liking rating of Chinese ideographs	−0.08
		106			Subliminal	Image	Neutral	Cognitive	Liking rating of Chinese ideographs	0.57
								Cognitive	Liking rating of Chinese ideographs	0.09
		106			Subliminal	Image	Positive affect	Cognitive	Liking rating of Chinese ideographs	0.23
								Cognitive	Liking rating of Chinese ideographs	0.05
Mikulincer, Hirschberger, et al. (2001) Study 2	Israel	90	Median = 22	Lab	Subliminal	Image	Baby	Cognitive	Liking rating of Chinese ideographs	0.66

(continued)

Table 1. (continued)

Author	Location	*N*	Age	Study setting	Level of awareness	Prime task/stimuli	Prime comparison	Outcome category	Specific outcome	*d*
		90			Subliminal	Image	Mother	Cognitive	Liking rating of Chinese ideographs	0.70
		90			Subliminal	Image	Neutral	Cognitive	Liking rating of Chinese ideographs	0.57
		90			Subliminal	Image	Positive affect	Cognitive	Liking rating of Chinese ideographs	0.22
Mikulincer, Hirschberger, et al. (2001) Study 3	Israel	80	Median = 23	Lab	Subliminal	Image	Mother-baby	Cognitive	Liking rating of Chinese ideographs	0.16
		80			Subliminal	Image	Neutral	Cognitive	Liking rating of Chinese ideographs	0.82
		80			Subliminal	Image	Positive affect	Cognitive	Liking rating of Chinese ideographs	−0.05
		80			Subliminal	Image	Young couple	Cognitive	Liking rating of Chinese ideographs	0.05
Mikulincer, Hirschberger, et al. (2001) Study 4	Israel	66	Median = 22	Lab	Subliminal	Name	Acquaintance	Cognitive	Liking rating of Chinese ideographs	0.59
		66			Subliminal	Name	Close other	Cognitive	Liking rating of Chinese ideographs	0.39
		66			Subliminal	Name	Unknown person	Cognitive	Liking rating of Chinese ideographs	0.45
Mikulincer, Hirschberger, et al. (2001) Study 5	Israel	100	Median = 24	Lab	Subliminal	Picture (death)	Control	Cognitive	Liking rating of Chinese ideographs	0.83
		100			Subliminal	Picture (death)	Neutral	Cognitive	Liking rating of Chinese ideographs	0.78
		100			Subliminal	Picture (death)	Positive affect	Cognitive	Liking rating of Chinese ideographs	0.90
		100			Subliminal	Picture (failure)	Control	Cognitive	Liking rating of Chinese ideographs	0.68
		100			Subliminal	Picture (failure)	Neutral	Cognitive	Liking rating of Chinese ideographs	0.70

(continued)

Table 1. (continued)

Author	Location	*N*	Age	Study setting	Level of awareness	Prime task/stimuli	Prime comparison	Outcome category	Specific outcome	*d*
		100			Subliminal	Picture (failure)	Positive affect	Cognitive	Liking rating of Chinese ideographs	0.78
		100			Subliminal	Picture (neutral)	Control	Cognitive	Liking rating of Chinese ideographs	0.37
		100			Subliminal	Picture (neutral)	Neutral	Cognitive	Liking rating of Chinese ideographs	0.36
		100			Subliminal	Picture (neutral)	Positive affect	Cognitive	Liking rating of Chinese ideographs	0.03
Mikulincer, Hirschberger, et al. (2001) Study 6	Israel	88	Median = 24	Lab	Subliminal	Picture (failure)	Control	Cognitive	Liking rating of Chinese ideographs	0.92
		88			Subliminal	Picture (failure)	Neutral	Cognitive	Liking rating of Chinese ideographs	0.90
		88			Subliminal	Picture (failure)	Positive affect	Cognitive	Liking rating of Chinese ideographs	0.90
		88			Subliminal	Picture (no feedback)	Control	Cognitive	Liking rating of Chinese ideographs	0.48
		88			Subliminal	Picture (no feedback)	Neutral	Cognitive	Liking rating of Chinese ideographs	0.48
		88			Subliminal	Picture (no feedback)	Positive affect	Cognitive	Liking rating of Chinese ideographs	−0.06
Mikulincer, Hirschberger, et al. (2001) Study 7	Israel	100	Median = 24	Lab	Subliminal	Picture (neutral)	Control	Cognitive	Liking rating of Chinese ideographs	0.72
		100			Subliminal	Picture (neutral)	Neutral	Cognitive	Liking rating of Chinese ideographs	0.71
		100			Subliminal	Picture (neutral)	Positive affect	Cognitive	Liking rating of Chinese ideographs	0.03
		100			Subliminal	Picture (separation)	Control	Cognitive	Liking rating of Chinese ideographs	1.00
		100			Subliminal	Picture (separation)	Neutral	Cognitive	Liking rating of Chinese ideographs	1.12
		100			Subliminal	Picture (separation)	Positive affect	Cognitive	Liking rating of Chinese ideographs	0.86
Mikulincer, Gillath, et al. (2001) Study 1		46			Supraliminal	Guided imagery	Neutral	Affective	Felt security	2.43

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Table 1. (continued)

Author	Location	*N*	Age	Study setting	Level of awareness	Prime task/stimuli	Prime comparison	Outcome category	Specific outcome	*d*
								Affective	Positive affect	1.08
		46			Supraliminal	Guided imagery	Positive affect	Affective	Distress	0.90
								Affective	Empathy	0.98
								Affective	Felt security	1.57
								Affective	Positive affect	−1.15
Mikulincer, Gillath, et al. (2001) Study 2	Israel	40	Median = 24	Lab	Supraliminal	Image	Neutral	Affective	Felt security	2.14
								Affective	Positive affect	0.92
		40			Supraliminal	Image	Positive affect	Affective	Felt security	1.00
								Affective	Passive identification	0.58
								Affective	Positive affect	−0.01
								Cog/Aff/Beh	Compassionate caring	0.70
Mikulincer, Gillath, et al. (2001) Study 3	Israel	40	Median = 23	Lab	Subliminal	Lexical decision task	Positive affect	Affective	Distress	0.58
								Cog/Aff	Empathy	0.77
Mikulincer, Gillath, et al. (2001) Study 4	Israel	48	Median = 24	Lab	Supraliminal	Image	Neutral	Cognitive	Reaction time for empathy memories	0.99
								Cognitive	Reaction time for distress	0.00
		48			Supraliminal	Image	Positive affect	Cognitive	Reaction time for empathy memories	0.61
								Cognitive	Reaction time for distress	0.16
Mikulincer, Gillath, et al. (2001) Study 5	Israel	48	Median = 23	Lab	Supraliminal	Image	Anxious	Affective	Distress	0.35
								Affective	Empathy	0.75
Mikulincer et al. (2003) Study 1	Israel	48	Median = 25	Lab	Supraliminal	Visualization	Control	Cognitive	Benevolence values	0.77
								Cognitive	Universalism values	0.68
		48			Supraliminal	Visualization	Neutral	Affective	Positive mood	0.10
		48			Supraliminal	Visualization	Positive affect	Affective	Positive mood	−0.69
Mikulincer et al. (2003) Study 2	Israel	40	Median = 23	Lab	Supraliminal	Visualization	Control	Cognitive	Benevolence values	1.06
								Cognitive	Universalism values	0.98

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Table 1. (continued)

Author	Location	*N*	Age	Study setting	Level of awareness	Prime task/stimuli	Prime comparison	Outcome category	Specific outcome	*d*
		40			Supraliminal	Visualization	Neutral	Affective	Positive affect	0.71
		40			Supraliminal	Visualization	Positive affect	Affective	Positive affect	0.06
Mikulincer et al. (2003) Study 3	Israel	44	Median = 24	Lab	Supraliminal	Visualization	Control	Cognitive	Benevolence values	0.82
								Cognitive	Universalism values	0.93
		44			Supraliminal	Visualization	Neutral	Affective	Positive affect	0.35
		44			Supraliminal	Visualization	Positive affect	Affective	Positive affect	−0.43
Mikulincer et al. (2005) Study 1	Israel/ United States	60	Median = 21	Lab	Subliminal	Lexical decision task	Acquaintance	Affective	Compassion (American)	0.68
								Affective	Compassion (Israeli)	0.63
								Affective	Distress (American)	0.21
								Affective	Distress (Israeli)	0.19
								Behavioral	Agree to help (American)	0.68
								Behavioral	Agree to help (Israeli)	0.78
								Cognitive	Willing to help (American)	0.63
								Cognitive	Willing to help (Israeli)	0.68
		60			Subliminal	Lexical decision task	Close other	Affective	Compassion (American)	0.67
								Affective	Compassion (Israeli)	0.69
								Affective	Distress (American)	0.08
								Affective	Distress (Israeli)	0.13
								Behavioral	Agree to help (American)	0.71
								Behavioral	Agree to help (Israeli)	0.86
								Cognitive	Willing to help (American)	0.71
								Cognitive	Willing to help (Israeli)	0.94
Mikulincer et al. (2005) Study 2	Israel/ United States	60	Median = 21	Lab	Supraliminal	Lexical decision task	Acquaintance	Affective	Compassion (American)	0.93
								Affective	Compassion (Israeli)	0.81
								Affective	Distress (American)	−0.19
								Affective	Distress (Israeli)	0.21
								Behavioral	Agree to help (American)	0.54
								Behavioral	Agree to help (Israeli)	0.56
								Cognitive	Willing to help (American)	0.62
								Cognitive	Willing to help (Israeli)	0.62
		60			Supraliminal	Lexical decision task	Exploration	Affective	Compassion (American)	0.62

(continued)

Table 1. (continued)

Author	Location	*N*	Age	Study setting	Level of awareness	Prime task/stimuli	Prime comparison	Outcome category	Specific outcome	*d*
								Affective	Compassion (Israeli)	0.57
								Affective	Distress (American)	0.16
								Affective	Distress (Israeli)	0.24
								Behavioral	Agree to help (American)	0.86
								Behavioral	Agree to help (Israeli)	0.69
								Cognitive	Willing to help (American)	0.94
								Cognitive	Willing to help (Israeli)	0.76
Mikulincer et al. (2005) Study 3	Israel / United States	60	Median = 20	Lab	Supraliminal	Thought (mood enhancement)	Neutral	Affective	Compassion (American)	0.89
								Affective	Compassion (Israeli)	0.82
								Affective	Distress (American)	−0.45
								Affective	Distress (Israeli)	−0.36
								Cognitive	Willing to help (American)	0.75
								Cognitive	Willing to help (Israeli)	0.78
		60			Supraliminal	Thought (no mood enhancement)	Neutral	Affective	Compassion (American)	0.15
								Affective	Compassion (Israeli)	−0.16
								Affective	Distress (American)	−0.35
								Affective	Distress (Israeli)	0.40
								Cognitive	Willing to help (American)	−0.10
								Cognitive	Willing to help (Israeli)	0.01
Mikulincer et al. (2005) Study 4	Israel/ United States	60	Median = 23	Lab	Supraliminal	Thought (empathic joy)	Neutral	Affective	Compassion (American)	0.11
								Affective	Compassion (Israeli)	0.16
								Affective	Distress (American)	−0.07
								Affective	Distress (Israeli)	−0.04
								Cognitive	Willing to help (American)	0.28
								Cognitive	Willing to help (Israeli)	0.27
		60			Supraliminal	Thought (no empathic joy)	Neutral	Affective	Compassion (American)	1.68
								Affective	Compassion (Israeli)	1.15
								Affective	Distress (American)	−0.07
								Affective	Distress (Israeli)	−0.02
								Cognitive	Willing to help (American)	1.32
								Cognitive	Willing to help (Israeli)	0.81

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Table 1. (continued)

Author	Location	*N*	Age	Study setting	Level of awareness	Prime task/stimuli	Prime comparison	Outcome category	Specific outcome	*d*
Mikulincer et al. (2005) Study 5	Israel/ United States	60	Median = 20	Lab	Supraliminal	Thought (high closeness)	Neutral	Affective	Compassion (American)	0.20
								Affective	Compassion (Israeli)	0.25
								Affective	Distress (American)	0.12
								Affective	Distress (Israeli)	−0.23
								Cognitive	Willing to help (American)	0.24
								Cognitive	Willing to help (Israeli)	0.38
		60			Supraliminal	Thought (low closeness)	Neutral	Affective	Compassion (American)	0.76
								Affective	Compassion (Israeli)	0.57
								Affective	Distress (American)	0.28
								Affective	Distress (Israeli)	−0.12
								Cognitive	Willing to help (American)	0.50
								Cognitive	Willing to help (Israeli)	0.93
Mikulincer et al. (2011) Study 1	Israel	50	Median = 22	Lab	Subliminal	Lexical decision task	Acquaintance	Behavioral	Problem solving	0.70
		50			Subliminal	Lexical decision task	Close other	Behavioral	Problem solving	0.74
		120			Subliminal	Lexical decision task	Neutral	Affective	Positive affect	0.49
Mikulincer et al. (2011) Study 2	Israel	75	Median = 22	Lab	Supraliminal	Guided imagery	Acquaintance	Affective	Positive affect	1.19
								Behavioral	Problem solving	0.52
		75			Supraliminal	Guided imagery	Control	Behavioral	Problem solving	0.52
Mikulincer et al. (2013)	Israel/ United States	68	Israeli couples: Mean = 24.15; American couples: Mean = 20.91	Online/ Lab	Subliminal	Stroop task (depletion)	Neutral	Behavioral	Caregiver negative support (American)	0.22
								Behavioral	Caregiver responsiveness (American)	1.15
		41			Subliminal	Stroop task (depletion)	Neutral	Behavioral	Caregiver negative support (Israeli)	0.55

(continued)

Table 1. (continued)

Author	Location	*N*	Age	Study setting	Level of awareness	Prime task/stimuli	Prime comparison	Outcome category	Specific outcome	*d*
								Behavioral	Caregiver responsiveness (Israeli)	1.33
		68			Subliminal	Stroop task (no depletion)	Neutral	Behavioral	Caregiver negative support (American)	0.04
								Behavioral	Caregiver responsiveness (American)	0.38
		37			Subliminal	Stroop task (no depletion)	Neutral	Behavioral	Caregiver negative support (Israeli)	0.76
								Behavioral	Caregiver responsiveness (Israeli)	0.76
Mikulincer et al. (2014) Study 1	Israel	40	Mean = 24.50	Online/ Lab	Subliminal	Stroop task (no threat)	Neutral	Behavioral	Negative support	0.44
		40			Subliminal	Stroop task (no threat)	Neutral	Behavioral	Responsiveness	0.64
		40			Subliminal	Stroop task (threat)	Neutral	Behavioral	Negative support	0.49
								Behavioral	Responsiveness	0.39
Mikulincer et al. (2014) Study 2	Israel	60	Mean = 21.92	Online/ Lab	Subliminal	Stroop task (depletion)	Neutral	Behavioral	Interference	−0.22
								Behavioral	Responsiveness	0.77
		60			Subliminal	Stroop task (no depletion)	Neutral	Behavioral	Interference	−0.33
								Behavioral	Responsiveness	−0.22
Millings et al. (2019) Study 2	United Kingdom	412	Mean = 25.16	Online	Supraliminal	Visualization	Neutral	Affective	Felt security	0.38
								Cognitive	Openness	0.17
Milyavskaya et al. (2012)	Canada	90	Mean = 19.44	Online/ Lab	Supraliminal	Visualization	Controlling	Behavioral	Task persistence	0.12
								Cognitive	Intrinsic motivation (self-report)	0.43
Nicola (2014)	Australia	214	Mean = 41	Online	Supraliminal	Visualization	Positive mood	Cognitive	Accommodation	0.06
								Cognitive	Assimilation	0.08
Norman et al. (2015)	United Kingdom	42	Mean = 20.88	Field/ Lab	Subliminal	Image	Neutral	Affective	Anxiety	−0.17
								Cog/Aff/Beh	Attachment anxiety	0.10
								Cog/Aff/Beh	Attachment avoidance	0.30
								Cognitive	Trait anxiety	−0.10

(continued)

Table 1. (continued)

Author	Location	*N*	Age	Study setting	Level of awareness	Prime task/stimuli	Prime comparison	Outcome category	Specific outcome	*d*
Otway et al. (2014)	United Kingdom	50	Mean = 22.43	Lab	Supraliminal	Visualization	Neutral	Affective	Felt security	1.14
Pardess et al. (2014) Study 3	United States	107	Median = 55	Lab	Supraliminal	Visualization	Neutral	Affective	Burnout	0.68
								Affective	Secondary traumatic stress	0.65
								Cognitive	Compassion satisfaction	0.37
Park (2007) Study 3	United States	43	Mean = 19.13	Lab	Supraliminal	Name	Control	Cognitive	Rejection sensitivity × Feelings of rejection	0.28
								Cognitive	Rejection sensitivity × Negative affect	0.26
								Cognitive	Rejection sensitivity × Positive affect	0.16
								Cognitive	Rejection sensitivity × State self-esteem	−0.20
Pepping et al. (2015) Study 2	Australia	32	Mean = 21.31	Online	Supraliminal	Visualization	Control	Affective	Felt security	1.02
								Cognitive	Self-compassion	2.10
Peterson Study 1 (2014)	United States	57	Mean = 18.7	Lab	Supraliminal	Visualization	Control	Cognitive	Explicit self-esteem	0.14
								Cognitive	Implicit self-esteem	−0.56
Peterson Study 2 (2014)	United States	101	Mean = 19.2	Lab	Supraliminal	Visualization	Control	Cognitive	Explicit self-esteem	−0.16
								Cognitive	Implicit self-esteem	−0.14
Pierce & Lydon (1998) Study 1	Canada	102	Mean = 19.2	Lab	Subliminal	Word	Control	Affective	Negative affect	0.05
								Affective	Positive affect	0.05
								Behavioral	Growth-oriented coping	0.00
								Behavioral	Seeking advice	0.12
								Behavioral	Seeking emotional support	0.24
								Cognitive/ Behavioral	Self-denigrating coping	0.20
		102			Subliminal	Word	Negative affect	Affective	Negative affect	0.09
								Affective	Positive affect	0.23
								Behavioral	Growth-oriented coping	0.12
								Behavioral	Seeking advice	0.03
								Behavioral	Seeking emotional support	0.14

(continued)

Table 1. (continued)

Author	Location	*N*	Age	Study setting	Level of awareness	Prime task/stimuli	Prime comparison	Outcome category	Specific outcome	*d*
								Cognitive/ Behavioral	Self-denigrating coping	0.13
Pierce & Lydon (1998) Study 2	Canada	52	Mean = 19.3	Lab	Subliminal	Word	Control	Affective	Negative affect	−0.10
								Affective	Positive affect	0.02
		52			Subliminal	Word	Negative affect	Affective	Negative affect	−0.09
								Affective	Positive affect	−0.02
Plusnin Study 2 (2014)	Australia	47	Mean = 23.31	Lab	Supraliminal	Guided imagery	Neutral	Cognitive	Perceived severity of moral transgression	−0.52
								Cognitive	Transgression severity (mortality salience condition)	−0.10
		47			Supraliminal	Guided imagery	Mortality salience	Cognitive	Perceived severity of moral transgression	−0.28
								Cognitive	Support for punishment	−0.24
Rowe & Carnelley (2003)	United Kingdom	266	Mean = 20.5	Lab	Supraliminal	Lexical decision task	Anxious	Affective	Emotionality	0.33
								Affective	Negative affect	2.96
								Affective	Positive affect	0.73
		320			Supraliminal	Lexical decision task	Anxious	Affective	Positive attachment word recall	0.50
								Affective	Positive expectations	0.40
								Cognitive	Negative attachment word recall	0.16
								Cognitive	Negative expectations	0.45
								Cognitive	Negative nonattachment word recall	0.38
								Cognitive	Positive nonattachment word recall	−0.27
		266			Supraliminal	Lexical decision task	Avoidance	Affective	Emotionality	0.14
								Affective	Negative affect	3.28
								Affective	Positive affect	0.71
								Affective	Positive attachment word recall	1.14
								Affective	Positive expectations	0.15
								Cognitive	Negative attachment word recall	0.17
								Cognitive	Negative expectations	0.01
								Cognitive	Negative nonattachment word recall	0.40

(continued)

Table 1. (continued)

Author	Location	*N*	Age	Study setting	Level of awareness	Prime task/stimuli	Prime comparison	Outcome category	Specific outcome	*d*
								Cognitive	Positive nonattachment word recall	−1.29
Sakaluk & Gillath (2016) Study 3	United States	228	Mean = 19.43	Lab	Supraliminal	Visualization	Insecurity	Behavioral	Number of condoms taken	0.18
								Behavioral	Number of condoms taken (self-focused)	1.06
Saleem et al. (2015) Study 1b	United States	279	Mean = 39.31	Lab	Supraliminal	Visualization	Neutral	Affective	Negative emotion toward outgroup	0.49
								Behavioral	Outgroup harm	0.75
Saleem et al. (2015) Study 3	United States	88	Mean = 37.27	Online	Supraliminal	Visualization	Secure	Affective	Negative emotion toward outgroup	−0.54
								Behavioral	Signing anti-ISIS petition	−0.28
								Cognitive	Negative stereotypes	−0.43
								Cognitive	Support for military aggression	−0.18
Saleem et al. (2015) Study 2	United States	139	Mean = 19.32	Lab	Supraliminal	Visualization	Secure	Affective	Negative affect	−0.49
								Behavioral	Outgroup harm	−0.75
Selterman & Maier (2013) Study 1	United States	60	Mean = 19.68	Online	Supraliminal	Guided imagery	Material reward	Affective	Jealousy	−0.09
		60			Supraliminal	Guided imagery	Neutral	Affective	Jealousy	−0.63
Selterman & Maier (2013) Study 2	United States	70	Not reported	Online	Supraliminal	Guided imagery	Material reward	Affective	Anger	−0.10
								Affective	Hurt	−0.42
								Affective	Upset	0.23
		70			Supraliminal	Guided imagery	Neutral	Affective	Anger	0.49
								Affective	Hurt	0.26
								Affective	Upset	0.52
								Physiological	Respiratory sinus arrhythmia (pleasant excitement)	0.09
Sutin & Gillath (2009) Study 2	United States	377	Mean = 19.3	Lab	Supraliminal	Guided imagery	Control	Affective	Emotional intensity	0.06
								Affective	Negative affect	0.06
								Affective	Positive affect	0.06
								Cognitive	Coherence	0.16

(continued)

Table 1. (continued)

Author	Location	*N*	Age	Study setting	Level of awareness	Prime task/stimuli	Prime comparison	Outcome category	Specific outcome	*d*
		352			Supraliminal	Guided imagery	Insecurity	Affective	Emotional intensity	0.05
								Affective	Negative affect	1.08
								Affective	Positive affect	0.13
								Cognitive	Coherence	0.32
Taubman-Ben-Ari & Mikulincer (2007) Study 1	Israel	93	Median = 18	Lab	Supraliminal	Image	Neutral	Cognitive/ Behavioral	Reckless driving	−0.16
Taubman-Ben-Ari & Mikulincer (2007) Study 2	Israel	47	Median = 18	Lab	Supraliminal	Image	Neutral	Cognitive/ Behavioral	Reckless driving	0.30
Taubman-Ben-Ari & Mikulincer (2007) Study 3	Israel	77	Median = 18	Lab	Supraliminal	Image	Neutral	Cognitive/ Behavioral	Reckless driving	0.06
Troyer & Greitemeyer (2018)	Austria	361	Mean = 29.1	Online	Supraliminal	Visualization	Insecurity	Affective	Emotion suppression	0.30
								Affective	Negative affect	0.35
								Affective	Rumination	0.26
								Cog/Aff/Beh	Attachment anxiety	0.29
								Cog/Aff/Beh	Attachment avoidance	0.30
								Cognitive	Trust	1.99
		353			Supraliminal	Visualization	Neutral	Affective	Emotion suppression	0.10
								Affective	Rumination	0.00
								Cog/Aff/Beh	Attachment anxiety	0.18
								Cog/Aff/Beh	Attachment avoidance	0.22
								Cognitive	Trust	1.50
Wilkinson et al. (2013)	United Kingdom	41	Mean = 29.19	Lab	Supraliminal	Visualization	Anxious	Affective	Anxiety	0.15
								Affective	Depression	0.55
								Affective	Distress	0.07
								Affective	Negative affect	0.43
								Affective	Positive affect	0.52
								Affective	Relaxation	0.93

Note. *N* = sample size, *d* = standardized mean difference: the effect size is coded in the direction that a positive d reflects that security priming was associated with a facilitative effect (increased a positive outcome or reduced a negative outcome), att. = attachment, aff = affective, beh = behavioral, cog = cognitive, field = field study, lab = laboratory study, online = online study; SO = significant other; *t* = time point; ISIS = Islamic State of Iraq and Syria.

Table 2. Outcome Variable Coding Criteria.

Outcome category (bolded) and outcome variables	*N*	*d*
Affective	**58**	**0.62**
Definition: Outcomes were coded as "affective" if they reflected discrete affect or mood as well as emotional well-being or emotion regulation.		
Negative affect	38	0.47
Depression	7	0.81
Anxiety	6	0.50
Distress and distress reduction	11	0.36
Upset, Hurt, Anger, Burnout, Stress, Dislike/Contempt, Indifference, Jealousy, Rejection		
Positive affect	39	0.84
Compassion	5	0.60
Empathy (Affective, Empathic memory recall, Cultural empathy)	10	0.74
Love	3	1.88
Tenderness/Positive sentiment, Forgiveness, Security, Happiness, Admiration/Respect, Friendship, Relaxation, Warmth, Wanting to protect		
Behavioral	**32**	**0.44**
Definition: Outcomes coded as "behavioral" constituted a particular behavioral response or commitment toward a behavioral act such **as** providing help to another or agreeing to help another in need.		
Caregiving	8	0.36
Caregiving avoidance, Caregiving anxiety, Secure base interference, Secure base availability, Safe haven, Caregiving responsiveness, Compassionate caregiving, Behavioral responsiveness, and Negative support		
Prosocial behavior	15	0.54
Positive helping behaviors toward outgroup, Compliance, Initiating/Maintaining ties, Secure behavioral choices, Number of condoms taken		
Agreeing to help	2	0.70
Problem-solving	3	0.67
Problem-solving		
Interpersonal problem-solving		
Willingness to interact with groups (overall)	2	0.64
Willingness to interact with out-group	2	1.24
Willingness to interact with in-group	2	0.05
Seeking support	2	0.20
Seeking emotional support	2	0.27
Seeking instrumental support		
Seeking advice		
Antisocial behavior	15	0.38
Willingness to steal	2	0.31
Lying and cheating	3	0.58
Outgroup harm, Negative support behaviors to outgroup Dissolving ties, Signing ISIS petition		
Cognitive	**75**	**0.45**
Definition: Outcomes coded as "cognitive" had a particular focus on attitudes, perceptions, or appraisals of others as well as cognitive processes or memory.		
Cognitive openness	6	0.38
Openness to God, Openness to abortion, Spending, Accommodation & Perspective taking, Change in perceptions		
Acceptance/Approval (of oneself or by others)	5	0.19
Body image	2	0.18
Social acceptance, Approval from others, Appearance, God's love		
Positive personal qualities	15	0.76
Benevolence values, Universalism values, Forgiveness, Authenticity, Honesty, Self-compassion, Virtue		
Prosocial qualities and inclinations	27	0.66
Helping	7	0.48
Communal orientation	2	0.31
Willingness to help		
Positive evaluation of others	6	0.68
Liking	8	0.54

(continued)

Table 2. (continued)

Outcome category (bolded) and outcome variables	*N*	*d*
Liking of others, Chinese ideograms (neutral stimuli)		
Positive evaluation of ingroups, Positive evaluation of outgroups, Friendliness of others, Positive evaluation of attachment figures		
Cognitive accessibility (Reaction time/Recall)	6	0.33
Trust	3	1.05
Trust & Trustworthiness in nonromantic others		
Threat/Distress	2	0.38
Immigrant threat & Reaction time for distressing stimuli		
Antisocial cognitions	6	0.23
Prejudice, Negative stereotypes, Social dominance orientation, Support for the war in Iraq, Support for the war in North Korea, Punishment, Competition		
Romantic Relationship evaluations	4	1.39
Trust, Closeness, Own & partner's contribution to relationship, Relationship satisfaction, Relationship equity		
Self-esteem	7	0.34
Reckless driving (Cognitive & Behavioral)	3	0.15
Physiological	**3**	**0.99**
Definition: Outcomes coded as "physiological" constituted some sort of response to a security prime that influenced aspects of one's physiology.		
Arousal, Skin conductance (electrodermal activity), Stress (cortisol levels), Negative affect (respiratory sinus arrhythmia: fear), Positive affect (respiratory sinus arrhythmia: pleasant excitement)		
Affective/Behavioral/Cognitive		
Definition: Outcomes in this category possess components of affective, behavioral, and cognitive outcomes, as detailed earlier.		
Felt security and Attachment security	16	1.34
Attachment anxiety	5	0.17
Attachment avoidance	5	0.21

Note. Moderators without an effect size were only examined by a single study or were not analyzed independently. The number of studies exceeds 119 because some studies were included across multiple outcome categories as they comprised multiple outcome variables. att = attachment; aff = affective; beh = behavioral; cog = cognitive; *N* = number of times a moderator was examined; *d* = standardized mean difference: the effect size is coded in the direction that a positive d reflects that security priming was associated with a facilitative effect (increased a positive outcome or reduced a negative outcome). ISIS = Islamic State of Iraq and Syria.

multiple assessments to yield an over-time priming effect average.[1] It is important to note that we undertook this approach due to the very small number of studies including extractable data on priming over multiple sessions and even fewer of these studies investigated security priming over time.

Publication bias. In line with recommendations regarding the assessment of publication bias (e.g., B. T. Johnson, 2020; Kepes et al., 2012), we assessed the presence of possible bias using several methods. First, we calculated the overall effect size for published and unpublished studies, thereby determining whether publication status moderated the effect size. Second, we conducted visual assessments of publication bias by inspecting the symmetry of the funnel plot. Specifically, this visual representation is a plot depicting study size on the vertical axis as a function of effect size on the horizontal axis. Large studies appear toward the top of the graph and tend to cluster near the mean effect size. Smaller studies appear toward the bottom of the graph and (as there is more sampling variation in effect size estimates in the smaller studies) will be dispersed across a range of values. In the absence of publication bias, studies are expected to be evenly distributed around the averaged effect size. By contrast, in the presence of bias, the bottom of the plot would show a higher concentration of studies on one side of the mean than the other. This would reflect the fact that smaller studies (which appear toward the bottom) are more likely to be published if they have larger than average effects, which is necessary for them to meet the criterion for statistical significance. We used Duval and Tweedie's Trim and Fill method to determine the possible number of missing studies due to the presence of publication bias in the funnel plot and then adjusting the effect size estimate to correct for this possible bias (Borenstein et al., 2009).

Finally, we conducted a cumulative analysis for publication bias. In a cumulative analysis, each study is sequentially added to the meta-analysis, with the meta-analytic effect estimated each time a new study is added until all studies are included in the estimation of the effect size. Cumulative meta-analysis can be used to examine the presence of

publication bias by estimating the effect size as a function of the study sample size. In this case, studies are sorted from largest to smallest N, and then the cumulative analysis is conducted. If the point estimate stabilizes with the inclusion of larger studies and does not shift with the addition of smaller studies, then the assumption is that the inclusion of studies with a smaller N has not imbued bias into the estimate. If the point estimate demonstrates a shift as the smaller studies are added, there is evidence for the presence of publication bias (Borenstein et al., 2009).

Results

The identification of articles through the searching of electronic databases using the search terms outlined (see Method section) revealed a total of 1,642 articles (with the removal of duplicates; Figure 1). Examination of these records through abstract and full-text review against the inclusion criteria resulted in a total of 120 studies across 97 published and unpublished articles for quantitative synthesis (see Figure 1). The details of these 120 studies are presented in Tables 1 and 2.

The results are divided into a series of sections. Descriptive summaries are provided regarding the research design, samples, and measures of the studies included in the meta-analysis. This is then followed by a reporting of the non-moderated and moderated security priming effect sizes.

Features and Design of Studies

Recruitment and study characteristics. As shown in Table 1, the majority of the studies were conducted in three countries, the United States ($k = 40$), Israel ($k = 28$), and the United Kingdom ($k = 13$). The remainder of the studies were conducted across the Asia-Pacific region and Europe. Six studies were conducted in parallel in both the United States and Israel. Eighty-six studies were done in the laboratory, 18 studies were conducted exclusively online (see Table 1), and 11 studies reported a mixed-methods design involving both laboratory and online procedures. Two studies did not provide adequate details to determine research methodology (e.g., whether conducted within the laboratory or in the field, pen-and-paper, or online administration; Deng et al., 2016; Troyer & Greitemeyer, 2018).

Sample characteristics. The sample size across all 120 studies totaled 18,949 participants. As shown in Table 1, there was great variability in sample size across studies ranging from 30 to 3,600 participants. More than 70% of studies involved samples of university students, 22% of the studies recruited participants from the wider community, while 8% of the studies involved samples that were recruited from both the university and the wider community. The mean age of participants across studies ranged from 17 to 55 years (see Table 1).

Outcomes. The studies demonstrated large variability in terms of outcomes; however, the majority of studies could be classified as cognitive, affective, or behavioral. Three studies were classified as investigating physiological outcomes. A total of 80 studies investigated cognitive outcomes. Of these studies, a number focused on prosocial or antisocial attitudes and values, desire to help others, positive evaluations of others, self-esteem, relationship evaluations, and cognitive accessibility and openness (see Table 1). A total of 61 studies focused on aspects of affect and emotional well-being as an outcome (negative affect [$k = 41$] and positive affect [$k = 21$]).[2] Several studies focused on affective outcomes such as depression, anxiety, and distress (as well as distress reduction) as well as positive outcomes such as empathy, compassion, and love. Finally, 44 studies focused on behavioral outcomes, with 26 studies investigating prosocial behaviors and 18 studies investigating antisocial behaviors (eight studies focused on both prosocial and antisocial behaviors). As shown in Table 1, caregiving behavior was the commonly studied outcome variable, with 24 studies focusing on behavioral outcomes such as interacting with in-group and out-group members. Other behavioral outcomes included support seeking, problem-solving, engaging in lying, cheating, and stealing.

Methodological aspects of studies: levels of awareness, priming task, and comparison conditions. Of the 120 studies, 82 used supraliminal priming, while 33 studies used subliminal priming. Two studies (Baldwin, 1994; Mikulincer, Hirschberger, et al., 2001) used both subliminal and supraliminal priming. Various studies used more than one type of security priming task. Sixty-seven (56%) studies asked participants to engage in a visualization/guided imagery task[3] involving a security-enhancing interaction, 20 studies involved exposing participants to security-related images, 20 studies involved exposing participants to security-related words, and 13 to the names of security providing attachment figures.

Across all but four studies (which conducted a pre-post analysis), the effects of security priming were tested against other priming conditions (e.g., insecurity priming) or a control condition. Several studies compared security priming to multiple contrasting conditions. Specifically, 80 studies included a control or neutral priming condition (see, Table 1); 21 studies compared the security prime to a positive affect condition, 19 compared the security prime to an attachment anxiety prime, 17 compared the name of security providing attachment figures to names of acquaintance/non-close other, 12 compared the security prime to an attachment avoidance prime, 7 compared an attachment figure to a significant other, 6 studies compared the security prime to an insecurity/mortality salience prime, 3 studies compared the security prime to a negative affect prime, 2 compared security to a significant other who was critical and communicated their dislike of the participant, and 1 study compared security to a self-esteem prime.

A total of 32 security priming studies investigated the moderating role of attachment style (see Table 3). Of these studies, 27 also investigated the unmoderated effect of security priming (these studies are also listed in Table 1). The majority of studies used supraliminal priming (n = 29), and the comparison group typically involved either a control/neutral prime (n = 21) or a positive affect/mood prime (n = 13).

Overall Effect Size and the Role of Priming Awareness, Stimulus/Task Type, Comparison Group, and Attachment Style

The overall effect size for security priming was large (d = .51, 95% CI [.43, .59] $p < .001$, $Q = 748.74$, $I^2 = 84.77$, k = 115). We next conducted subgroup analysis to determine the extent to which this effect size differed by the level of priming awareness (subliminal and supraliminal), type of prime task/stimulus (e.g., words and images), comparison group (e.g., control/neutral, insecure, and positive mood), and attachment style. In relation to the level of priming awareness, subliminal priming of attachment security was associated with a large effect size (d = .63, 95% CI [.47, .79], $p <$ .001, Q = 189.67, I^2 = 83.12, k = 33) and supraliminal priming with a moderate effect size (d = .46, 95% CI [.38, .54], $p < .001$, Q =522.83, I^2 =84.32, k = 83). The difference in the effect size across these subgroups was significant, $Q(1) = 3.91$, $p < .05$.

In terms of prime stimulus/task type, viewing images (d = .63, 95% CI [.42, .84] $p <$.001, $Q = 90.32$, $I^2 = 83.39$, k = 16) as well as exposure to attachment security-related words (d = .63, 95% CI [.39; .84] $p < .001$, $Q = 221.72$, I^2 = 90.53, k = 22) were found to produce the largest effect sizes. These were followed by recalling/listing the names of attachment figures and close others (d = .55, 95% CI [.36, .74] $p < .001$, $Q = 20.82$, $I^2 = 47.16$, $k = 12$), and guided imagery/visualization tasks (d = .44, 95% CI [.34, .54] $p <$ .001, $Q = 375.73$, $I^2 = 82.97$, $k = 65$). However, no significant differences were found across any of the subgroups, $Q(4) = 4.00$, $p > .05$.

The effects for security priming were largest when the comparison condition entailed a mortality salience or insecurity prime (d = 1.01, 95% CI [.25, 1.78] $p < .01$, $Q = 201.39$, $I^2 = 97.02$, $k = 7$), followed by attachment avoidance (d = .69, 95% CI [.35, 1.03] $p < .001$, $Q = 96.49$, $I^2 = 88.60$, k = 12), an acquaintance/non-close other (d = .61, 95% CI [.45, .77] $p < .001$, $Q = 18.53$, $I^2 = 29.83$, $k = 14$), attachment anxiety (d = .59, 95% CI [.36, .82] $p < .001$, $Q = 113.45$, I^2 = 84.13, $k = 19$), a control/neutral condition (d = .54, 95% CI [.44, .64] $p < .001$, $Q = 441.78$, $I^2 = 82.34$, $k = 79$), a close other that is not an attachment figure (d = .44, 95% CI [.23, .65] $p < .001$, $Q = 3.26$, $I^2 = 0.00$, $k = 6$), and positive affect (d = .28, 95% CI [.13, .43] $p < .001$, $Q = 42.95$, I^2 = 51.10, $k = 22$). Three types of comparison conditions were found to not significantly moderate the effects of security priming, and these were an unknown other (d = 1.08, 95% CI [−.16, 2.32] $p >$.05, $Q = 11.37$, $I^2 = 91.20$, $k = 2$), a critical or unsupportive other (d = .50, 95% CI [−.11; 1.19] $p >$.06, $Q = 30.13$, $I^2 = 50.21$, $k = 3$) and negative affect (d = .07, 95% CI [−.25;.39] $p >$.05, $Q = 0.21$, $I^2 = 0.00$, k = 2). The difference in the effect size across these subgroups was significant, $Q(9) = 44.89$, $p < .001$. However, these statistical differences were limited to the positive affect and negative affect comparison conditions. Specifically, the effects of security priming were significantly larger when comparison conditions involved the priming of an acquaintance/non-close other, avoidance, and a control/neutral prime than when studies involved a positive or negative affect prime (z = 2.62–3.01, ps .003–.015). Furthermore, the effects of security priming were significantly larger when the comparison condition involved an attachment figure/close other than when a negative affect prime was utilized (z = 2.28, $p < .05$) and when an insecurity prime comparison condition was used than when a positive affect prime was used ($z = 2.04$, $p < .05$)

The overall effect of security priming was not found to differ by attachment style, with both attachment anxiety (d = .16, 95% CI [−.05, .37] $p > .05$, $Q = 136.50$, $I^2 = 80.95$, k = 32) and attachment avoidance (d = .06, 95% CI [−.11, .23] $p >$.05, $Q = 65.05$, $I^2 = 60.03$, $k = 31$) demonstrating small and nonsignificant effect sizes. Furthermore, subgroup analysis revealed no difference between the effect sizes, $Q(1)$ = .20, $p > .05$. However, attachment anxiety (d = .72, 95% CI [.25, 1.18] $p <$ .0003, $Q = 5.89$, $I^2 = 66.05$, $k = 3$) and avoidance (d = .52, 95% CI [.13, .91] $p <$.001, $Q = 4.20$, I^2 = 52.37, $k = 3$) were associated with large security priming effect sizes for studies that used subliminal priming, but not supraliminal priming (attachment anxiety [d = .10, 95% CI [−.13, .33] $p > .05$, $Q = 113.58$, $I^2 = 80.63$, $k = 28$]; avoidance [d = −.0002, 95% CI [−.19; .18] $p > .05$, $Q = 46.66$, I^2 = 55.70, k = 27]). The security priming effects related to attachment anxiety and attachment avoidance did not significantly differ for subliminal, $Q(1) = .65$, $p > .05$, or supraliminal studies, $Q(1) = .20$, $p > .05$. In summary, the overall effects of security priming are not dependent on attachment style; however, attachment style was found to be a factor when the method of security priming was subliminal in nature. Specifically, the effect was stronger for anxiety than for avoidance.

Security priming by outcome type. Using subgroup analysis, we examined the effects of security as a function of outcome type. We initially examined whether the effect of security priming varied as a function of whether an outcome could be classified as cognitive, behavioral, or affective (see Canterberry & Gillath, 2012). We also examined whether effect sizes differed by level of priming awareness, prime task, comparison condition, and attachment style across these three broad outcome categories. We then conducted a further set of subgroup analyses concerning outcomes, but we

Table 3. Study Characteristics and Effect Size (Studies Including Attachment Style as a Moderator).

Author	Location	*N*	Age	Study setting	Attachment style	Prime comparison	Specific outcome	Outcome category	Level of awareness	*d*
Andriopoulos & Kafetsios (2015)	Greece	72	Mean = 20.07	Lab	Anxious	Control	Attentional bias—vigilance/avoidance	Cognitive	Subliminal	0.47
					Secure	Control	Attentional bias—vigilance/avoidance	Cognitive	Subliminal	0.11
Bale (2014) Study 3	Australia	151	Mean = 49.99	Online	Anxious	Neutral	Negative affect	Affective	Supraliminal	–0.65
					Anxious	Neutral	Prosocial behavior (safe haven support)	Behavioral	Supraliminal	–0.08
					Anxious	Neutral	Prosocial behavior (secure base availability)	Behavioral	Supraliminal	–0.52
					Anxious	Neutral	Prosocial behavior (secure base encouragement)	Behavioral	Supraliminal	0.90
					Anxious	Neutral	Prosocial behavior (secure base interference)	Behavioral	Supraliminal	0.49
					Anxious	Neutral	Self-esteem	Cognitive	Supraliminal	–0.02
					Avoidant	Neutral	Negative affect	Affective	Supraliminal	–0.45
					Avoidant	Neutral	Prosocial behavior (safe-haven support)	Behavioral	Supraliminal	0.37
					Avoidant	Neutral	Prosocial behavior (secure base availability)	Behavioral	Supraliminal	–0.20
					Avoidant	Neutral	Prosocial behavior (secure base encouragement)	Behavioral	Supraliminal	–0.82
					Avoidant	Neutral	Prosocial behavior (secure base interference)	Behavioral	Supraliminal	0.72
					Avoidant	Neutral	Self-esteem	Cognitive	Supraliminal	–0.52
Bale (2014) Study 4	Australia	180	Mean = 54.82		Anxious	Neutral	Distress reduction	Affective	Supraliminal	–0.32
					Anxious	Neutral	Receipt of safe-haven support	Behavioral	Supraliminal	–0.02
					Anxious	Neutral	Receipt of secure-base availability	Behavioral	Supraliminal	0.10
					Anxious	Neutral	Receipt of secure-base encouragement	Behavioral	Supraliminal	–0.80
					Anxious	Neutral	Receipt of secure-base interference	Behavioral	Supraliminal	–0.37
					Anxious	Neutral	Self-esteem	Cognitive	Supraliminal	0.12
					Avoidant	Neutral	Distress reduction	Affective	Supraliminal	0.35
					Avoidant	Neutral	Receipt of safe-haven support	Behavioral	Supraliminal	1.09
					Avoidant	Neutral	Receipt of secure-base availability	Behavioral	Supraliminal	0.43
					Avoidant	Neutral	Receipt of secure-base encouragement	Behavioral	Supraliminal	0.35
					Avoidant	Neutral	Receipt of secure-base interference	Behavioral	Supraliminal	–0.24
					Avoidant	Neutral	Self-esteem	Cognitive	Supraliminal	–0.39
Bryant & Chan (2017)	Australia	75	Mean = 19.26	Lab	Anxious	Control	Negative affect	Affective	Supraliminal	–0.44
					Avoidant	Control	Negative affect	Affective	Supraliminal	–0.10
					Low anxiety	Control	Negative affect	Affective	Supraliminal	–0.05
					Low avoidance	Control	Negative affect	Affective	Supraliminal	–0.53
Bryant & Hutanamon (2018)	Australia	62	Mean = 19.17	Lab	Avoidant	Neutral	Negative affect	Affective	Supraliminal	0.83
					Anxious	Neutral	Negative affect	Affective	Supraliminal	0.16
Cassidy et al. (2009)	United States	70	Median = 19	Lab	Anxious	Neutral	Negative affect (severity)	Affective	Subliminal	–0.30

(continued)

Table 3. (continued)

Author	Location	*N*	Age	Study setting	Attachment style	Prime comparison	Specific outcome	Outcome category	Level of awareness	*d*
					Anxious	Neutral	Constructive-PS coping	Behavioral	Subliminal	0.63
					Anxious	Neutral	Crying	Behavioral	Subliminal	–0.49
					Anxious	Neutral	Defensive/hostile coping	Behavioral	Subliminal	0.26
					Anxious	Neutral	Negative affect	Affective	Subliminal	–0.37
					Anxious	Neutral	Positive affect	Affective	Subliminal	0.10
					Anxious	Neutral	Negative affect (rejection)	Affective	Subliminal	–0.54
					Avoidant	Neutral	Negative affect (severity)	Affective	Subliminal	0.41
					Avoidant	Neutral	Constructive-PS coping	Behavioral	Subliminal	–0.32
					Avoidant	Neutral	Crying	Behavioral	Subliminal	0.47
					Avoidant	Neutral	Defensive/hostile coping	Behavioral	Subliminal	0.70
					Avoidant	Neutral	Negative affect	Affective	Subliminal	0.24
					Avoidant	Neutral	Positive affect	Affective	Subliminal	–0.04
					Avoidant	Neutral	Negative affect (rejection)	Affective	Subliminal	0.75
Cassidy et al. (2018) Study 1	United States	153	Mean = 19.5	Online/Lab	Avoidant	Neutral	Cognitive empathy	Cognitive	Supraliminal	–0.58
					Anxious	Neutral	Cognitive empathy	Cognitive	Supraliminal	0.08
					Avoidant	Neutral	Prosocial behavior (caregiving anxiety)	Behavioral	Supraliminal	–0.85
					Anxious	Neutral	Prosocial behavior (caregiving anxiety)	Behavioral	Supraliminal	0.08
					Avoidant	Neutral	Prosocial behavior (caregiving avoidance)	Behavioral	Supraliminal	0.47
					Anxious	Neutral	Prosocial behavior (caregiving avoidance)	Behavioral	Supraliminal	–0.30
Cassidy et al. (2018) Study 2	United States	154	Mean = 19.8	Online/Lab	Avoidant	Neutral	Cognitive empathy	Cognitive	Supraliminal	–0.77
					Anxious	Neutral	Cognitive empathy	Cognitive	Supraliminal	1.50
					Avoidant	Neutral	Prosocial behavior (caregiving anxiety)	Behavioral	Supraliminal	0.32
					Anxious	Neutral	Prosocial behavior (caregiving anxiety)	Behavioral	Supraliminal	–0.08
					Avoidant	Neutral	Prosocial behavior (caregiving avoidance)	Behavioral	Supraliminal	0.28
					Anxious	Neutral	Prosocial behavior (caregiving avoidance)	Behavioral	Supraliminal	–0.68
T. J. Collins & Gillath (2012) Study 4	United States	153	Median = 21	Field	Anxious	Neutral	Relationship dissolution	Behavioral	Supraliminal	–1.28
					Avoidant	Neutral	Relationship dissolution	Behavioral	Supraliminal	–0.56
T. J. Collins & Gillath (2012) Study 5	United States	97	Median = 21	Field	Anxious	Neutral	Relationship dissolution	Behavioral	Supraliminal	–0.56
					Avoidant	Neutral	Relationship dissolution	Behavioral	Supraliminal	–0.82
Gillath et al. (2017) Study 3	United States	80	Median = 21	Lab	Anxious	Neutral	Relationship dissolution	Behavioral	Supraliminal	–0.49

(continued)

Table 3. (continued)

Author	Location	*N*	Age	Study setting	Attachment style	Prime comparison	Specific outcome	Outcome category	Level of awareness	*d*
					Anxious	Neutral	Relationship initiation	Behavioral	Supraliminal	–0.39
					Anxious	Neutral	Relationship maintenance	Behavioral	Supraliminal	0.45
					Avoidant	Neutral	Relationship dissolution	Behavioral	Supraliminal	–0.47
					Avoidant	Neutral	Relationship initiation	Behavioral	Supraliminal	–0.70
					Avoidant	Neutral	Relationship maintenance	Behavioral	Supraliminal	–0.54
Hudson & Fraley (2018)	United States	88	Mean = 20.15	Online	Anxious	Control	Attachment anxiety	Cog/Aff/Beh	Supraliminal	0.06
					Anxious	Control	Attachment anxiety (x time)	Cog/Aff/Beh	Supraliminal	–0.02
Li et al. (2016) Study 1	China	63	Mean = 23.13	Lab	Anxious	Acquaintance	Cognitive accessibility	Cognitive	Supraliminal	0.12
					Avoidant	Acquaintance	Cognitive accessibility	Cognitive	Supraliminal	–0.22
Mallinckrodt et al. (2013) Study 1	United States	92	Mean = 21.88	Field	Anxious	Positive affect	Empathy	Cognitive	Supraliminal	–0.12
					Avoidant	Positive affect	Empathy	Cognitive	Supraliminal	–0.16
Mallinckrodt et al. (2013) Study 2	United States	88	Mean = 23.42	Field	Anxious	Positive affect	Empathy	Cognitive	Supraliminal	–0.20
					Avoidant	Positive affect	Empathy	Cognitive	Supraliminal	0.15
Mikulincer, Hirschberger, et al. (2001)	Israel	106	Median = 24	Lab	Anxious	Control	Positive appraisal	Cognitive	Subliminal (neutral)	0.52
					Anxious	Control	Positive appraisal	Cognitive	Subliminal (separation)	1.94
					Anxious	Neutral	Positive appraisal	Cognitive	Subliminal (neutral)	0.64
					Anxious	Neutral	Positive appraisal	Cognitive	Subliminal (separation)	1.90
					Anxious	Positive affect	Positive appraisal	Cognitive	Subliminal (neutral)	0.02
					Anxious	Positive affect	Positive appraisal	Cognitive	Subliminal (separation)	1.68
					Avoidant	Control	Positive appraisal	Cognitive	Subliminal (neutral)	0.57
					Avoidant	Control	Positive appraisal	Cognitive	Subliminal (separation)	1.37
					Avoidant	Neutral	Positive appraisal	Cognitive	Subliminal (neutral)	0.76
					Avoidant	Neutral	Positive appraisal	Cognitive	Subliminal (separation)	1.57

(continued)

Table 3. (continued)

Author	Location	*N*	Age	Study setting	Attachment style	Prime comparison	Specific outcome	Outcome category	Level of awareness	*d*
					Avoidant	Positive affect	Positive appraisal	Cognitive	Subliminal (neutral)	–0.13
					Avoidant	Positive affect	Positive appraisal	Cognitive	Subliminal (separation)	1.13
					Fearful	Control	Positive appraisal	Cognitive	Subliminal (neutral)	0.88
					Fearful	Control	Positive appraisal	Cognitive	Subliminal (separation)	0.04
					Fearful	Neutral	Positive appraisal	Cognitive	Subliminal (neutral)	0.73
					Fearful	Neutral	Positive appraisal	Cognitive	Subliminal (separation)	–0.16
					Fearful	Positive affect	Positive appraisal	Cognitive	Subliminal (neutral)	0.13
					Fearful	Positive affect	Positive appraisal	Cognitive	Subliminal (separation)	–0.09
					Secure	Control	Positive appraisal	Cognitive	Subliminal (neutral)	0.73
					Secure	Control	Positive appraisal	Cognitive	Subliminal (separation)	0.96
					Secure	Neutral	Positive appraisal	Cognitive	Subliminal (neutral)	0.67
					Secure	Neutral	Positive appraisal	Cognitive	Subliminal (separation)	1.65
					Secure	Positive affect	Positive appraisal	Cognitive	Subliminal (neutral)	0.04
					Secure	Positive affect	Positive appraisal	Cognitive	Subliminal (separation)	1.25
Mikulincer, Gillath, et al. (2001) Study 1	Israel	46	Median = 24	Lab	Anxious	Positive affect	Negative affect	Affective	Supraliminal	–0.26
					Anxious	Positive affect	Affective empathy	Affective	Supraliminal	0.87
					Avoidant	Positive affect	Negative affect	Affective	Supraliminal	0.35
					Avoidant	Positive affect	Affective empathy	Affective	Supraliminal	–0.30
Mikulincer, Gillath, et al. (2001) Study 2	Israel	40	Median = 24	Lab	Anxious	Positive affect	Prosocial behavior	Behavioral	Supraliminal	0.10
					Anxious	Positive affect	Negative affect	Affective	Supraliminal	0.47
					Avoidant	Positive affect	Prosocial behavior	Behavioral	Supraliminal	0.39
					Avoidant	Positive affect	Negative affect	Affective	Supraliminal	0.24

(continued)

Table 3. (continued)

Author	Location	*N*	Age	Study setting	Attachment style	Prime comparison	Specific outcome	Outcome category	Level of awareness	*d*
Mikulincer, Gillath, et al. (2001) Study 3	Israel	40	Median = 23	Lab	Anxious	Positive affect	Negative affect	Affective	Supraliminal	−0.32
					Anxious	Positive affect	Affective empathy	Affective	Supraliminal	0.24
					Avoidant	Positive affect	Negative affect	Affective	Supraliminal	0.49
					Avoidant	Positive affect	Affective empathy	Affective	Supraliminal	0.14
Mikulincer, Gillath, et al. (2001) Study 4	Israel	48	Median = 24	Lab	Anxious	Positive affect	Negative affect	Affective	Supraliminal	1.32
					Anxious	Positive affect	Affective empathy	Affective	Supraliminal	9.85
					Avoidant	Positive affect	Negative affect	Affective	Supraliminal	6.86
					Avoidant	Positive affect	Affective empathy	Affective	Supraliminal	2.76
Mikulincer et al. (2003) Study 1	Israel	48	Median = 25	Lab	Anxious	Positive affect	Prosocial attitudes (benevolence)	Cognitive	Supraliminal	−0.63
					Anxious	Positive affect	Prosocial attitudes (universalism)	Cognitive	Supraliminal	−0.98
					Avoidant	Positive affect	Prosocial attitudes (benevolence)	Cognitive	Supraliminal	1.06
					Avoidant	Positive affect	Prosocial attitudes (universalism)	Cognitive	Supraliminal	1.12
Mikulincer et al. (2003) Study 2	Israel	40	Median = 23	Lab	Anxious	Positive affect	Prosocial attitudes (benevolence)	Cognitive	Supraliminal	−0.41
					Anxious	Positive affect	Prosocial attitudes (universalism)	Cognitive	Supraliminal	0.49
					Avoidant	Positive affect	Prosocial attitudes (benevolence)	Cognitive	Supraliminal	−0.90
					Avoidant	Positive affect	Prosocial attitudes (universalism)	Cognitive	Supraliminal	−0.82
Mikulincer et al. (2003) Study 3	Israel	44	Median = 24	Lab	Anxious	Positive affect	Prosocial attitudes (benevolence)	Cognitive	Supraliminal	−0.85
					Anxious	Positive affect	Prosocial attitudes (universalism)	Cognitive	Supraliminal	−1.06
					Avoidant	Positive affect	Prosocial attitudes (benevolence)	Cognitive	Supraliminal	−2.67
					Avoidant	Positive affect	Prosocial attitudes (universalism)	Cognitive	Supraliminal	−0.28
Mikulincer et al. (2011)	Israel	75	Median = 22	Lab	Anxious	Control	Problem solving	Behavioral	Supraliminal	−0.98
					Low anxiety	Control	Problem solving	Behavioral	Supraliminal	1.91
Milyavskaya et al. (2012)	Canada	90	Mean = 19.44	Online/Lab	Anxious	Controlling	Motivation—intrinsic (behavioral)	Behavioral	Supraliminal	−0.68
					Anxious	Controlling	Motivation—intrinsic	Cognitive	Supraliminal	−0.49
					Avoidant	Controlling	Motivation—intrinsic (behavioral)	Behavioral	Supraliminal	0.14
					Avoidant	Controlling	Motivation—intrinsic	Cognitive	Supraliminal	−0.43
Nicola (2014)	Australia	214	Mean = 41	Lab	Anxious	Positive affect	Cognitive openness	Cognitive	Supraliminal	−0.35
					Anxious	Positive affect	Cognitive inflexibility	Cognitive	Supraliminal	0.20
					Avoidant	Positive affect	Cognitive openness	Cognitive	Supraliminal	0.68
					Avoidant	Positive affect	Cognitive inflexibility	Cognitive	Supraliminal	−0.24
					Insecurity	Positive affect	Cognitive openness	Cognitive	Supraliminal	−0.06

(continued)

Table 3. (continued)

Author	Location	*N*	Age	Study setting	Attachment style	Prime comparison	Specific outcome	Outcome category	Level of awareness	*d*
					Insecurity	Positive affect	Cognitive inflexibility	Cognitive	Supraliminal	−0.04
Pardess et al. (2014)	United States	107	Median = 55	Lab	Anxious	Neutral	Compassion fatigue	Affective	Supraliminal	−0.14
					Anxious	Neutral	Prosocial attitudes	Cognitive	Supraliminal	−0.02
					Anxious	Neutral	Negative affect	Affective	Supraliminal	−0.12
					Avoidant	Neutral	Compassion fatigue	Affective	Supraliminal	0.02
					Avoidant	Neutral	Prosocial attitudes	Cognitive	Supraliminal	0.39
					Avoidant	Neutral	Negative affect	Affective	Supraliminal	−0.04
Peterson (2014) Study 1	United States	57	Mean = 18.7	Lab	Anxious	Control	Self-esteem (explicit)	Cognitive	Supraliminal	−0.39
					Anxious	Control	Self-esteem (implicit)	Cognitive	Supraliminal	−0.52
					Avoidant	Control	Self-esteem (explicit)	Cognitive	Supraliminal	0.12
					Avoidant	Control	Self-esteem (implicit)	Cognitive	Supraliminal	0.26
Peterson (2014) Study 2	United States	101	Mean = 19.2	Lab	Anxious	Control	Self-esteem (explicit)	Cognitive	Supraliminal	0.30
					Anxious	Control	Self-esteem (implicit)	Cognitive	Supraliminal	−0.87
					Avoidant	Control	Self-esteem (explicit)	Cognitive	Supraliminal	−0.41
					Avoidant	Control	Self-esteem (implicit)	Cognitive	Supraliminal	0.47
Taubman-Ben-Ari & Mikulincer (2007) Study 1	Israel	93	Median = 18	Lab	Anxious	Neutral	Reckless driving	Behavioral	Supraliminal	0.63
					Avoidant	Neutral	Reckless driving	Behavioral	Supraliminal	0.18
					Low anxiety	Neutral	Reckless driving	Behavioral	Supraliminal	−0.80
Taubman-Ben-Ari & Mikulincer (2007) Study 2	Israel	47	Median = 18	Lab	Anxious	Neutral	Reckless driving	Behavioral	Supraliminal	0.65
					Avoidant	Neutral	Reckless driving	Behavioral	Supraliminal	0.14
					Low anxiety	Neutral	Reckless driving	Behavioral	Supraliminal	−0.52
Taubman-Ben-Ari & Mikulincer (2007) Study 3	Israel	77	Median = 18	Lab	Anxious	Neutral	Reckless driving	Behavioral	Supraliminal	0.70
					Avoidant	Neutral	Reckless driving	Behavioral	Supraliminal	−0.06
					Low anxiety	Neutral	Reckless driving	Behavioral	Supraliminal	−0.63

Note. *N* = sample size; *d* = standardized mean difference: the effect size is coded in the direction that a positive d reflects that security priming was associated with a facilitative effect (increased a positive outcome or reduced a negative outcome); aff = affective; beh = behavioral; cog = cognitive; field = field study; lab = laboratory study; online = online study.

focused on specific outcomes this time. For instance, regarding affect, we examined the effects of security priming for positive and negative affect. We also separately analyzed the effect of security priming on attachment styles as this outcome was classified as entailing a mix of cognitive, affective, and behavioral components.

Cognitive outcomes. Security priming was found to have a moderate effect on cognitive outcomes (d = .45, 95% CI [.35, .56] $p < .001$, Q = 566.90, I^2 = 86.95, k = 75). Level of priming awareness, prime task, and comparison condition (but not attachment style) moderated this effect size (see Table 2). In particular, subliminal priming (d = .51, 95% CI [.40, .61] $p < .001$, Q = 33.97, I^2 = 44.07, k = 20) yielded a larger effect size than supraliminal priming (d = .43, 95% CI [.29, 0.56], $p < .001$, Q = 530.74, I^2 = 89.64, k = 56). However, subgroup analysis revealed no significant difference between the effect sizes, $Q(1)$ = .82, $p > .05$. Priming attachment security using the names of attachment figures/close others (d = .53, 95% CI [.38, .69], $p < .001$, Q = 5.16, I^2 = .00, k = 9) and through the use of words (d = .52, 95% CI [.34, .70], $p < .001$, Q = 24.14, I^2 = 62.72, k =10) demonstrated large effect sizes. Priming through the use of images (d = .43, 95% CI [.29, .58], $p < .001$, Q = 28.62, I^2 = 58.07, k = 13) and by way of a guided imagery/visualization task (d = .43, 95% CI [.27, .60], $p < .001$, Q = 499.34, I^2 = 91.59, k = 43) demonstrated moderate effect sizes. Subgroup analysis revealed no significant differences for prime stimulus/task, $Q(4)$ = 11.18, p = .05.

Security priming had the largest effect size on cognitive outcomes when the comparison condition was a mortality salience/insecurity prime[4] (d = 1.59, 95% CI [.23, 2.96], $p <$ .05, Q = 268.38, I^2 = 98.51, k =5). This was followed by priming attachment avoidance (d = .69, 95% CI [.27, 1.11], $p < .01$, Q = 79.77, I^2 = 91.23, k =8), attachment anxiety (d = .65, 95% CI [.26, 1.04], $p < .01$, Q = 82.81, I^2 = 90.34, k =9), an acquaintance or non-close other (d = .49, 95% CI [.33, .64] $p < .001$, Q = 7.55, I^2 = 0.48, k =9), a close other who was not an attachment figure (d = .46, 95% CI [.12, .80] $p <$. 01, Q = 2.99, I^2 = 33.21, k =3), exposure to a neutral/control prime (d = .42, 95% CI [.30, .54] $p < .001$, Q = 238.04, I^2 = 78.58, k = 52), and priming positive affect (d = .35, 95% CI [.21, .50] $p < .001$, Q = 23.73, I^2 = 36.78, k = 16). Priming a critical self/other as part of a comparison condition did not moderate the effect of security priming (d = .32, 95% CI [−.22, .86] $p > .05$, Q = 1.53, I^2 = 34.55, k = 2). However, subgroup analysis revealed no significant differences between the above effect sizes, $Q(7)$ = 10.36, $p >$ .05. In relation to the moderating role of attachment styles, both attachment anxiety (d = −.02, 95% CI [−.33, .28] $p >$ .05, Q = 130.29, I^2 = 87.72, k = 17) and avoidance (d = −.13, 95% CI [−.44, .18] $p > .05$, Q = 133.38, I^2 = 88.00, k = 17) were not found to moderate the effect of security priming on cognitive outcomes.

In terms of specific cognitive outcomes, Table 2 shows that security priming had the greatest effect (in descending order) on enhancing relationship evaluations, maintaining prosocial attitudes and values, a desire to help others, evaluating others positively, enhancing the liking of people and neutral stimuli, increasing cognitive accessibility and openness, and increasing perceptions of self and other acceptance/approval. Security priming was not found to have a significant effect on perceptions of body image, self-esteem, antisocial attitudes and values, cognitive accessibility of threat/distress, appraising others as trustworthy, and reckless driving (see Table 2). The differences between these categories of outcomes were significant, $Q(13)$ = 288.41, $p < .001$. Specifically, effects for security priming were significantly larger for prosocial attitudes than they were for relationship evaluations, cognitive accessibility, self-esteem, and antisocial attitudes (zs = 6.90–4.44, ps < .001). Moreover, the effects for security priming were significantly larger for relationship evaluations than for perceptions of acceptance/approval (z = 3.34, $p < .001$), and for body image (z = 5.72, $p < .001$).

Affective outcomes. Security priming was also found to have a moderate effect size in relation to affective outcomes (d = .62, 95% CI [.47, .77], $p < .001$, Q = 527. 16, I^2 = 89.00, k = 59). Priming method, prime task, and comparison condition (but not attachment style) moderated this effect size (see Table 1). The moderated effects for subliminal and supraliminal priming methods were large, but the magnitude of the effect size was greater for subliminal priming (d = .80, 95% CI [.30, 1.30], $p < .01$, Q = 147.62, I^2 = 92.55, k =12) than for supraliminal priming (d = .58, 95% CI [.43; .73], $p < .001$, Q = 378.50, I^2 = 87.85, k = 47). However, subgroup analysis revealed no significant difference between the effect sizes, $Q(1)$ =.66, $p > .05$. With regard to prime stimuli/task, exposure to images had the largest effect size (d = .91, 95% CI [.30, 1.53], $p < .01$, Q = 25.79, I^2 = 84.49, k = 5), followed by words (d = .75, 95% CI [.34, 1.17], $p < .01$, Q = 147.64, I^2 = 92.55, k = 12), the name of an attachment figure or close other (d = .64, 95% CI [.12, 1.16], $p < .05$, Q = 24.26, I^2 = 79.39, k = 6), and guided imagery/visualization (d = .54, 95% CI [.37, .71] $p < .001$, Q = 290.29, I^2 = 87.94, k = 36). Subgroup analyses also revealed no significant differences between the effect sizes relating to prime stimuli/task for affective outcomes, $Q(4)$ = 2.83, $p > .05$.

Security priming had the largest effect sizes on affective outcomes when the comparison condition was the priming of attachment anxiety (d = .93, 95% CI [.42, 1.45], $p < .001$, Q = 30.83, I^2 = 83.78, k = 6) and an acquaintance or non-close other (d = .90, 95% CI [.58, 1.21], $p < .001$, Q = 10.57, I^2 = 52.69, k = 6). These were followed by studies in which the comparison was a control/neutral condition (d = .70, 95% CI [.50, .90], $p < .001$, Q = 363.05, I^2 = 88.71, k = 42), priming attachment avoidance (d = .62, 95% CI [.002, 1.22], $p < .05$,

$Q = 21.92$, $I^2 = 86.31$, $k = 4$), and priming general feelings of insecurity ($d = .35$, 95% CI [.20, .49], $p < .001$, $Q = 1.27$, $I^2 = .00$, $k = 3$). Comparison condition did not moderate the effect of attachment security when it entailed positive affect ($d = .07$, 95% CI [−.20, .34], $p > .05$, $Q = 28.75$, $I^2 = 61.74$, $k = 12$), or negative affect ($d = .09$, 95% CI [−.22, .41], $p > .05$, $Q = 0.32$, $I^2 = 0.57$, $k = 2$). Subgroup analyses revealed significant differences between the effect sizes, $Q(6) = 15.94$, $p < .05$. In particular, the effects for security priming on affective outcomes were significantly smaller in studies in which the comparison condition was a positive affect prime compared with studies that used an acquaintance/non-close other comparison condition or a control/neutral condition, ($z = -3.31$ to -2.38, ps = .01–.001). Moreover, the effects for security priming on affective outcomes were significantly larger in studies which used a non-close other comparison compared with studies that primed attachment anxiety as a comparison ($z = 2.13$, $p < .05$). In relation to the moderating role of attachment styles, both attachment anxiety ($d = .16$, 95% CI [−.05; .36], $p > .05$, $Q = 15.92$, $I^2 = 49.76$, $k = 9$) and avoidance ($d = .06$, 95% CI [−.20; .31], $p > .05$, $Q = 23.51$, $I^2 = 65.97$, $k = 9$) were not found to moderate the effect of security priming on affective outcomes.

In terms of particular affective outcomes, we first analyzed the effect of security priming on general negative affect and specific aspects of emotional well-being (e.g., anxiety, depression, and distress). Although we attempted to examine the effect of security priming on discrete emotions (e.g., anger and hurt), we could not estimate meta-analytic effects as there were no multiple studies to extract estimates for a specific emotion. Overall, security priming was found to reduce general negative affect ($d = .47$, 95% CI [.22, .71], $p < .001$, $Q = 691.08$, $I^2 = 94.50$, $k = 39$). In terms of specific emotional well-being aspects, security priming was found (in descending order) to reduce depression, anxiety, and distress (see Table 2).

We also examined the effects of security priming on general positive affect as well as specific positive emotions. Security priming increased general positive affect ($d = .84$, 95% CI [.62, 1.05], $p < .001$, $Q = 432.73$, $I^2 = 91.45$, $k = 38$) as well as specific positive emotions (in descending order) such as love, affective empathy, and compassion (see Table 2). Subgroup analyses revealed that the effect size for enhancing positive affect was significantly larger than reducing negative affect ($z = 2.15$, $p < .05$).

Behavioral outcomes. Security priming also had a moderate effect size in relation to behavioral outcomes ($d = .44$, 95% CI [.33, .54], $p < .001$, $Q = 100.77$, $I^2 = 69.24$, $k = 32$). Level of awareness, prime stimuli/task, comparison condition, and attachment style moderated this effect size (see Table 2). Subliminal priming ($d = .43$, 95% CI [.23, .63], $p < .001$, $Q = 17.27$, $I^2 = 47.89$, $k = 10$) and supraliminal priming ($d = .44$, 95% CI [.32; .56], $p < .001$, $Q = 79.29$, $I^2 = 73.51$, $k = 22$) yielded similar effect sizes. Subgroup analysis revealed no significant difference between the effect sizes, $Q(1) = .005$, $p > .05$. With regard to prime stimuli/task, guided imagery/visualization ($d = .45$, 95% CI [.34, .56], $p < .001$, $Q = 38.87$, $I^2 = 51.12$, $k = 20$) and exposure to the name of an attachment figure or close other ($d = .47$, 95% CI [.19, 0.75], $p < .01$, $Q = 0.78$, $I^2 = 0.00$, $k = 2$) demonstrated similar effect sizes, followed by exposure to words ($d = .40$, 95% CI [.20; .61], $p < .001$, $Q = 30.33$, $I^2 = 70.33$, $k = 10$). Subgroup analyses revealed significant differences between these effect sizes, $Q(2) = 25.60$, $p < .001$. Specifically, the effects for security priming on behavioral outcomes were significantly smaller for studies which utilized security-related words ($z = -3.70$, $p < .001$), and the name of an attachment figure ($z = -2.19$, $p < .05$).

Security priming had the largest effect size on behavioral outcomes when the comparison condition was attachment avoidance priming ($d = .71$, 95% CI [.30; 1.13], $p < .001$, $Q = 0.75$, $I^2 = 0.00$, $k = 2$), followed by priming an attachment figure or close other ($d = .59$, 95% CI [.32, .87], $p < .001$, $Q = 2.45$, $I^2 = 0.00$, $k = 4$), an acquaintance or non-close other ($d = .59$, 95% CI [.42, .76], $p < .001$, $Q = 2.78$, $I^2 = 0.00$, $k = 6$), positive affect/mood ($d = .46$, 95% CI [.11, .81], $p < .02$, $Q = 0.26$, $I^2 = 0.00$, $k = 2$), a control/neutral stimulus ($d = .36$, 95% CI [.23, .48] $p < .001$, $Q = 41.65$, $I^2 = 56.27$, $k = 19$), and attachment anxiety priming ($d = .36$, 95% CI [.19, .54] $p < .001$, $Q = 2.67$, $I^2 = 0.00$, $k = 4$). Subgroup analyses revealed significant differences between the effect sizes $Q(5) = 11.78$, $p < .05$). Specifically, the effects for security priming for behavioral outcomes were significantly larger in studies which used a close other comparison compared with studies that used an attachment anxiety comparison ($z = 2.06$, $p < .05$) or a control comparison ($z = 2.18$, $p < .05$). In relation to the moderating role of attachment styles, both attachment anxiety and avoidance were found to moderate the effect of security priming for behavioral outcomes. However, this effect was larger for attachment anxiety ($d = .48$, 95% CI [.14, .81] $p < .001$, $Q = 98.77$, $I^2 = 88.86$, $k = 12$) than attachment avoidance ($d = .18$, 95% CI [.01, .36] $p < .05$, $Q = 30.41$, $I^2 = 67.11$, $k = 11$).

In terms of particular behavioral outcomes, we first analyzed the effects of security priming on general prosocial behavior and specific types of behaviors (e.g., helping behavior and interacting with members of other groups). Security priming was found to facilitate prosocial behaviors ($d = .54$, 95% CI [.34, .74] $p < .001$, $Q = 70.41$, $I^2 = 80.12$, $k = 15$). As shown in Table 2, security priming increased specific prosocial behaviors (in descending order): agreeing to help others, engaging in problem-solving, interacting with in-group and out-group members, providing sensitive and responsive caregiving, and seeking emotional support. However, security priming was not associated with seeking social support overall (i.e., the combined outcome of emotional, instrumental, and informational support).

Second, we analyzed the effects of security priming on general antisocial behavior and specific forms of antisocialism. Security priming was found to reduce antisocial

behaviors ($d = .38$, 95% CI [.24, .52] $p < .001$, $Q = 32.08$, $I^2 = 56.36$, $k = 15$). As shown in Table 2, security priming reduced stealing as well as and lying/cheating behaviors. The differences between these categories of outcomes were significant, $Q(2) = 14.30$, $p < .001$. Specifically, effects for security priming were significantly larger for prosocial behavior than it was for the provision of social support ($z = 7.83$, $p < .001$) and for antisocial behavior ($z = 3.27$, $p < .01$). In addition, security priming had a significantly larger effect on antisocial behavior than it did on social support provision ($z = 5.18$, $p < .001$).

Comparing the effect sizes across cognitive, affective, and behavioral outcomes. In addition to conducting subgroup analyses to determine whether the security priming effect size differed by methodological aspects of studies and specific cognitive, affective, and behavioral outcomes, we also conducted a subgroup analysis to determine if the effect of security priming differed *between* these broad outcome categories. Subgroup analysis revealed significant differences in the effect size across these three broad categories of outcome variables, $Q(2) = 61.34$, $p < .001$. Specifically, the security priming effect size was larger in studies with affective outcomes ($d = .62$) compared with those with cognitive outcomes ($d = .43$, $z = 2.17$, $p < .05$) and behavioral outcomes ($d = .44$, $z = 2.00$, $p < .05$).

Outcomes characterized as a combination of cognitive, affective, behavioral components. The only outcome that was coded as including cognitive, affective, and behavioral components was attachment styles. Security priming increased attachment security ($d = 1.34$, 95% CI [.97, 1.70], $p < .001$, $Q = 173.18$, $I^2 = 90.76$, $k = 17$) reduced attachment avoidance ($d = .21$, 95% CI [.09, .33], $p = .001$, $Q = 4.32$, $I^2 = .00$, $k = 6$), and reduced attachment anxiety ($d = .17$, 95% CI [.05, .29], $p < .01$, $Q = 4.51$, $I^2 = .00$, $k = 6$).

Physiological outcomes. Only three studies assessed physiological outcomes (cortisol, respiratory sinus arrhythmia [index of positive excitement]). Security priming was found to enhance physiological indicators (i.e., reduce stress and heighten pleasant excitement; $d = 1.00$, 95% CI [.04, 1.95], $p < .05$, $Q = 10.88$, $I^2 = 81.61$, $k = 3$)

Publication Bias

We examined the possible presence of publication bias for the overall effect size of security priming and each of the three broad outcomes (i.e., affective, cognitive, and behavioral) separately. We also examined whether publication bias was present in studies that differed on the methodological aspects employed (e.g., supraliminal vs. subliminal level of awareness and prime task/stimuli). We used several methods to explore publication bias, including whether the overall effect for security priming varies by the publication status of included studies (published or unpublished), an inspection of the funnel plots, and publication bias correction (adjustment) of effect sizes (by way of the Duval and Tweedie's Trim and Fill method) and a cumulative meta-analysis in which studies were sorted by sample size from largest to smallest. We report on each of these methods subsequently.

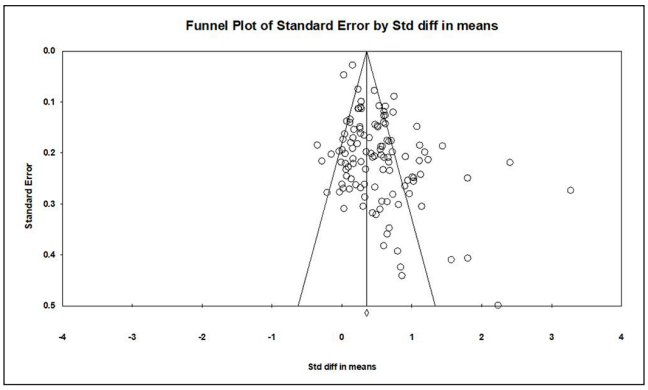


Figure 2. Funnel plot (overall effect size for security priming).

Publication status. We analyzed whether publication status (published vs. unpublished studies) affected the combined effect size by conducting a moderator analysis. The overall effect size was found to vary by publication status with published studies producing a larger effect size ($d = .53$, 95% CI [.45, .61], $p < .001$, $Q = 712.89$, $I^2 = 85.13$, $k = 106$) than unpublished studies ($d = .29$, 95% CI [.02, .56], $p < .05$, $Q = 29.04$, $I^2 = 69.01$, $k = 9$). Subgroup analysis revealed this difference to statistically significant, $Q(1) = 4.77$, $p < .05$.

Funnel plot. Visual inspection of the funnel plot (see Figure 2) illustrates a higher concentration of studies on the bottom right side of the mean. That is, studies with smaller sample sizes were more likely to be published if they had larger average effect sizes.

The impact of bias. To estimate the impact of the bias, we used Duval and Tweedie's Trim and Fill method and conducted a cumulative meta-analysis. Each of these estimates of bias is reported subsequently.

Trim and fill. The Trim and Fill method was used to locate the unbiased effect for the overall effect size, the effect size for each of the three broad outcome categories (affective, cognitive, and behavioral), and priming methods employed (i.e., level of awareness and priming task/stimuli). The overall unbiased effect size was deemed to be a moderate effect size under the random-effects model ($d = .27$ [95% CI: .18, .35], $p < .01$). This overall effect was attenuated compared with the unadjusted overall effect. Furthermore, as shown in Table 4, the adjusted effect sizes were attenuated relative to the unadjusted effect sizes across the broad cognitive, affective, and behavioral outcomes categories. However, the effects of security

Table 4. Adjusted Effect sizes for Trim and Fill Method.

	d			
	Outcome			
Study methodological Elements	Overall	Cognitive	Affective	Behavioral
	.27	.27	.39	.21
Level of awareness				
Supraliminal	.22	.19	.40	.21
Subliminal	.45	.47	.34	.41
Stimulus/task				
Guided imagery/visualization	.26	.36	.31	.43
Images/pictures	.63	.40	1.22	-
Words	.20	.43	.72	.18
Names of attachment figures/close others	.55	.49	.64	-
Comparison group				
Attachment avoidance	.14	.18	.62	-
Attachment anxiety	.14	-	.93	.29
Acquaintance/non-close other	.43	.35	.97	.59
Attachment figure/close other	.49	.44	-	.52
Close other not attachment figure	.43	-	-	-
Positive affect/mood	.20	.29	.11	-
Unknown other	-	-	-	-
Critical unsupportive other	.55	-	-	-
Negative affect/mood	-	-	-	-
Control/neutral	.26	.25	.35	.20
Mortality salience/insecurity	1.01	1.59	.33	-

Note. Effect sizes (*d*) reflect adjusted effect sizes for the possible presence of publication bias based on Duval and Tweedie's Trim and Fill Method: The effect size is coded in the direction that a positive d reflects that security priming was associated with a facilitative effect (increased a positive outcome or reduced a negative outcome). Dashes (-) represent that adjusted effect size could not be computed as <3 studies.

priming on affective outcomes seemed to demonstrate the least attenuation (unadjusted $d = .62$ vs. adjusted $d = .40$).

In terms of the level of awareness, the Trim and Fill adjusted effect sizes demonstrated some attenuation (vs. unadjusted effect sizes) for both subliminal and supraliminal studies (see Table 4); however, subliminal studies seem to show less attenuation than supraliminal studies (subliminal: unadjusted $d = .63$ vs. adjusted $d = .45$; supraliminal: unadjusted $d = .46$ vs. adjusted $d = .22$). In terms of priming stimulus/task, the use of images/pictures appeared to evidence no attenuation, and recalling the names of attachment figures or close others evidence only a slight attenuation in effect size (Trim and Fill adjusted vs. unadjusted; see Table 4). In relation to the use of guided imagery/visualization or words (e.g., love and hug), the Trim and Fill adjusted effect size was small compared with the unadjusted effect size. Given that the presence of publication bias based on the Trim and Fill method varied as a function of outcomes and methodological aspects of priming studies, we conducted a further breakdown of publication bias by combining across methodological aspects where possible (e.g., subliminal studies that focused on affective outcomes, employed words, and used a control/neutral comparison group). These analyses are presented in Supplement 1.

Cumulative analysis. The cumulative meta-analysis is presented in Figure 3 in which studies are sorted by sample size from largest to smallest *N*. The forest plot shows that the effect size for the overall effect of security priming stabilizes at a $d = .51$ (95% CI: .37; .64) when 35 studies with the largest sample sizes (i.e., a sample size for which the effect size was estimated with a power $\geq .80$) are included in the cumulative analysis (see up to Boag & Carcelle, 2016 [Study 1] in Figure 3).[5] Beyond this point, the overall point estimate demonstrates little deviation, with the effect size varying between $d = .46$ and $d = .51$. Thus, given that the effect size shows no discernable shift with the inclusion of studies with smaller sample sizes, there is little by way of prima facie evidence for bias. In summary, the analysis of publication bias is somewhat mixed. Although publication status (published vs. unpublished studies), funnel plot, and Trim and Fill method suggest evidence of bias, the cumulative meta-analysis suggests little evidence of publication bias.

Discussion

The current article is the first meta-analysis on the effects of security priming. It provides important insights into the state of the field regarding the effectiveness of contextually

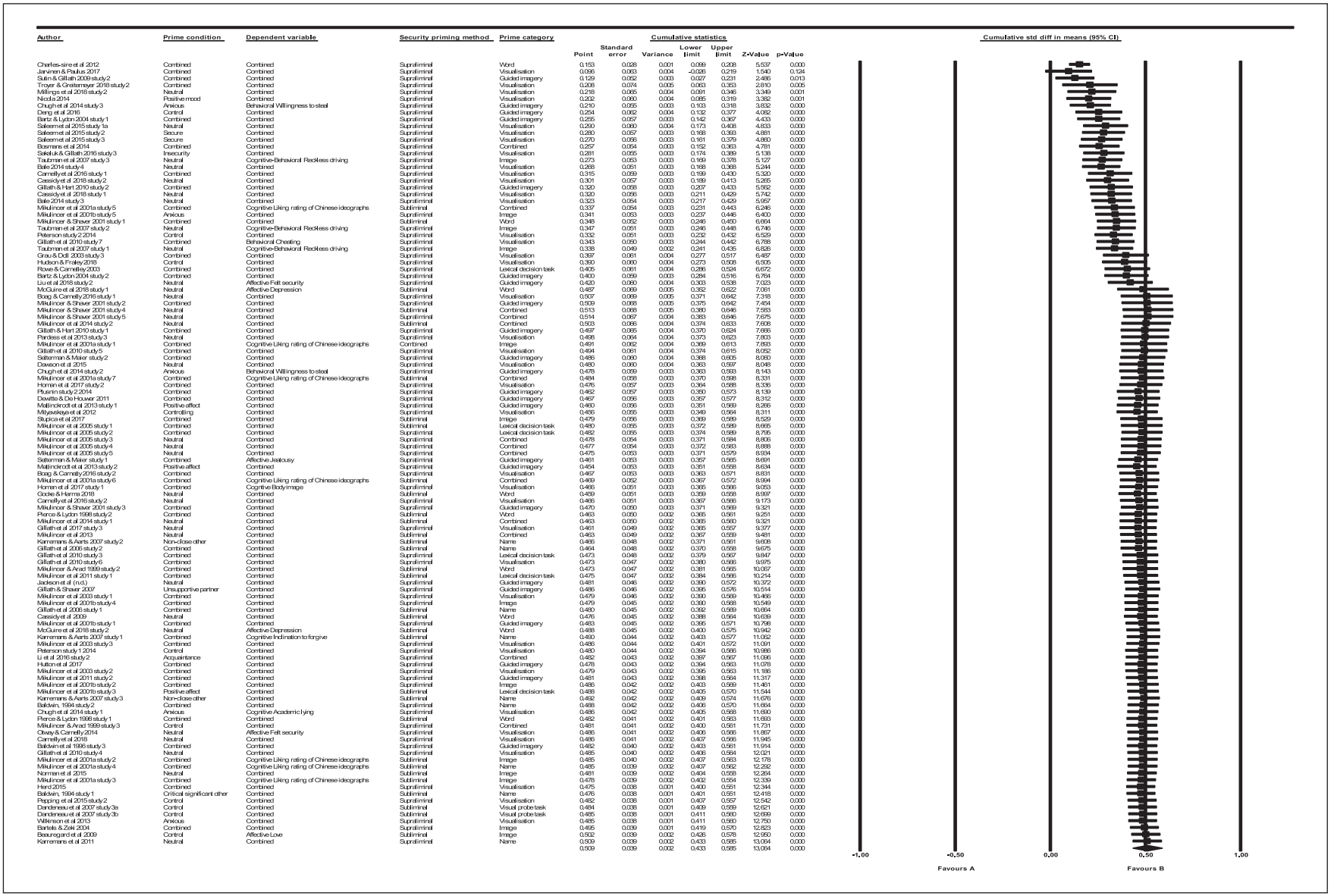


Figure 3. Cumulative meta-analysis and forest plot.

enhancing felt security, moderators of security priming, and the existence of publication bias. Across 120 published and unpublished studies, priming people with attachment security yielded a sizable positive effect size, and the effectiveness of security priming extended across affective, cognitive, and behavioral domains. The largest effect was found for affect-related outcomes, followed by cognitive, and behavioral outcomes that had similar overall effect sizes.

One explanation for why the effect is larger for the affective outcome domain compared with cognitive and behavioral domains is that a major (if not *the* major) function of the behavioral attachment system is affect/distress regulation. When the system is activated, the dynamics that underlie the system bring about affective changes to reestablish a sense of felt security (Bowlby 1969/1982, Gillath et al., 2016; Mikulincer & Shaver, 2016). To this end, priming security can not only reduce feelings of distress and anxiety but also heighten the experience of positive emotions (Gillath & Karantzas, 2019). Thus, security priming not only attenuates negative affect but also facilitates the "broadening and building cycle" of attachment security (Mikulincer & Shaver, 2016). It is therefore not surprising that the largest effect of priming security was found for affective outcomes.

A different explanation has to do with the widely acknowledged challenge of invoking behavioral change and the literature on attitudinal resistance. Bringing about behavioral change by any number of means is difficult (such as breaking a bad habit; Duhigg, 2012; Jager, 2003; Kelly & Barker, 2016). Berkman (2018) argues that behavioral changes are difficult to impose because they require both motivational and cognitive change. This difficulty may explain why we found a weaker effect of security priming on behavioral outcomes. In terms of cognition, the outcome variables in this meta-analysis ranged between supraliminal and subliminal measures of cognitions related to attitudes, beliefs, and other evaluative judgments. Research into attitude change generally suggests that contextual cues, such as priming stimuli, are more effective for attitude change and cognitive shifts concerning implicit rather than explicit attitudes (see Petty & Briñol, 2010, for a review). Thus, the overall effect size for cognition as a general outcome may be interpreted as reflecting an average of the effect of security priming across implicit and explicit facets of cognition—a feature that aligns with the level of awareness at which the security prime was delivered—either subliminal or supraliminal. Indeed, when we looked at the effects separately for subliminal and supraliminal studies, we found that the effect size was larger for subliminal priming ($d = .51$) compared with supraliminal priming ($d = .41$).

Within each of the broad outcome categories (affective, cognitive, and behavioral), security priming was found to yield large effects for particular outcome variables. In terms of particular affective outcomes, security priming was found to enhance positive emotions (such as love, empathy, and compassion) and to attenuate negative emotions but in particular symptoms of depression and anxiety as well as feelings of distress. Thus, security priming appears to enhance emotional well-being via two pathways. On the one hand, it boosts feelings of positivity, and on the other, it facilitates the reduction of negative emotions. In this respect, security priming largely encompasses the functions of a stronger and wiser other in assisting an individual in regulating their emotions (in line with the safe haven function of attachment; Gillath & Ai, 2021; Rowe et al., 2020).

Concerning cognitive outcomes, security priming was found to have large effect sizes with regard to positive relationship evaluations and harboring prosocial attitudes and values. What is interesting is that these cognitive outcomes focus on how one views others and the quality of interactions with close others. Thus, it may well be that security priming especially affects the working models of others. This may, in part, be due to the large number of studies that prime security by having people think, visualize, or complete guided imagery regarding interactions with other people. This type of task is likely to heighten positive relationship evaluations and prosocial attitudes (N. L. Collins & Feeney, 2000).

In terms of particular behavioral outcomes, security priming was found to enhance prosocial behaviors such as helping and caring for others and reduce antisocial behaviors such as lying and stealing. Much like cognitive outcomes, it appears that security priming enhances one's positivity toward others by enacting help and support and by inhibiting negative acts against other people (in line with the secure base function of attachment; Mikulincer et al., 2005; Mikulincer & Shaver, 2001).

Another question we tackled as part of this meta-analysis was whether subliminal and supraliminal priming work to the same degree. Not many articles directly address this question. In one such article where subliminal and supraliminal security primes were compared (Canterberry & Gillath, 2012), it was found that subliminal priming resulted in a more subtle (weaker) effect in brain activation over supraliminal priming. In another article, Mikulincer et al. (2005) concluded that both methods (subliminal and supraliminal) work in the same way or are equally effective (although no specific explanation was provided by the authors). In the current meta-analysis, we had the advantage of comparing these two priming methods across multiple studies and found that subliminal priming yielded larger effects than supraliminal priming. This might be because subliminal primes evoke less resistance or noise (due to other constructs being activated) than supraliminal primes. It can also be the case that supraliminal primes (e.g., recall a relationship) generate more variability (some people have a harder time recalling or recall different relationships with different characteristics, some less secure than others).

Despite the variety of prime tasks/stimuli used across studies, all were found to yield moderate effect sizes, and no significant differences were found between task/stimulus types. Previous qualitative reviews on security priming,

which limited the set of included studies (a rapid systematic review of papers published over a 2-year period; Gillath & Karantzas, 2019, a systematic review with a focus on affective outcomes; Rowe et al., 2020), found that priming through guided imagery/visualization was particularly effective as was the use of images. However, the meta-analysis reported in the present article significantly expands on past reviews by including an additional 92 studies spanning more than 20 years, with many of these studies including a more diverse array of priming methods and outcomes. The broader and more inclusive nature of the present synthesis allowed us to identify a critical mass of past studies that speak to the effectiveness of various priming tasks/stimuli that enhance attachment security. We discuss some of the main reasons these tasks/stimuli can prime a sense of security.

The facilitative effects of images in priming attachment security are not entirely surprising and in line with the recent systematic review by Rowe et al. (2020) and work from Winkielman and Gogolushko (2018; see also Spruyt et al., 2002). Winkielman and Gogolushko, who drew on privileged access theories (Glaser, 1992; Potter et al., 1986) and embodiment theories (de Gelder et al., 2011) to explain their findings, argue that affective meaning may be best conveyed through pictures as they also contribute to eliciting somatosensory and motor responses associated with the activated affective state.

As for the effect of names of attachment figures and security-enhancing words, we suggest that similar to the cocktail party effect (e.g., Getzmann et al., 2016), people tend to pay more attention to words (inclusive of names) that carry a personal significance for them. Moreover, the names of attachment figures and security-enhancing words may require less perceptual information than non-attachment words to trigger identification (Driver, 2001). Furthermore, priming attachment-related words and names of attachment figures is likely to prime past relationship experiences of love, comfort, and security and so people can draw on a bank of positive and security-enhancing interactions that cut across a variety of affective, cognitive, and behavioral outcomes.

When we analyzed the effects of security priming as compared with other types of primes, we found the effects for security priming to hold against all comparisons. Typically, the contrast between security priming and other primes that ranged in type and valence (such as priming attachment avoidance and self-esteem) yielded large effect sizes. Security priming was also found to yield a moderate effect size when compared with a positive affect prime. One question that is raised by some researchers is whether priming a sense of security produces effects that are all that different from enhancing a person's positive mood. The findings of this meta-analysis suggest that security priming does indeed yield effects that are larger when compared with positive affect primes. However, it is clear that the effects of security priming are larger when the comparison condition is of a non-affective nature.

With regard to the effects of priming over repeated sessions and the time-course assessment of priming, the meta-analysis demonstrated that security priming was not associated with any significant effects. That said, only a few studies examined the effects of security longitudinally, and some studies could not be included in the current meta-analysis because we could not extract data for the calculation of effect sizes. Furthermore, there was wide variability in the methodologies employed in longitudinal studies with regard to the primes participants were exposed to as well as the duration of study follow-up. In comparison to our analysis, Rowe and colleagues (2020) in their systematic review, identified five studies assessing long-term effects of security priming on affective outcomes. Their review showed that security priming either enhanced positive affect or reduced negative affect across all studies. What is clear from the findings of the current meta-analysis and the review by Row and colleagues is that research into the longitudinal effects of security priming is still in its infancy, and thus, more studies are required. Research in this area in the future would need to investigate the time lag between priming sessions, the priming duration at any point in time, the time between the last priming session and the outcome variables, and the number of repetitions included in a given priming session. These variables would need to be examined alongside the moderating variables that we investigated as part of this meta-analysis. Only then will we have a comprehensive insight into the effects of repeated security priming over time.

The last factor we examined was attachment style. Researchers often suggest that priming works for most (if not all) individuals irrespective of their attachment style (e.g., Gillath et al., 2016; Mikulincer & Shaver, 2007, 2016). The rationale being that even those who are insecure are likely to have experienced some security-enhancing interactions as part of past close relationships that are stored in long-term memory (Gillath et al., 2008; Mikulincer & Shaver, 2016). It is these security-enhancing interactions that priming makes salient, enabling even insecure individuals to experience a sense of security temporarily. Our results largely support this claim; the overall findings for security priming suggest a moderate effect size regardless of a person's attachment style.

However, we did find that the effect sizes for subliminal priming and behavioral outcomes was larger for attachment anxiety than attachment avoidance. We are hesitant to speculate and provide a specific explanation for these findings. The moderated effects of attachment anxiety and avoidance on subliminal priming were based on only three studies, so it is likely premature to draw firm conclusions and explanations from such a small sample of studies. In terms of the behavioral outcomes, approximately 80% of these studies included a neutral comparison prime. The effect size did not reliably change when we estimated it based on studies only employing a neutral comparison prime.[6] Thus, it may well be that the moderating effects of attachment styles on behavioral outcomes are driven more by the comparison prime (in

this instance, a neutral comparison prime) than by attachment style per se.

Limitations

Although this meta-analysis into security priming provides novel insights into the state of the field, some limitations need to be addressed. First, in terms of study characteristics, the majority of studies were carried out in three countries (84 of 119 studies or 71%), inside laboratories (as opposed to out in the field), off-line (as opposed to online), and with university students (60%). These characteristics highlight that the meta-analysis comprises a relatively homogeneous set of studies that may limit the generalizability of the results. However, these study characteristics do suggest that priming effects are not bound to one country or a particular laboratory.

Second, and related to the issue of study homogeneity, the majority of studies included cognitive outcomes, followed by affective outcomes, and only about a quarter of the studies included behavioral outcomes. The smaller number of behavioral studies (relative to studies with cognitive or affective outcomes) somewhat limited our ability to conduct moderator analyses for specific behavioral outcomes and thus hampers the generalizability of some of our conclusions. For instance, researchers have investigated the effects of security priming on important attachment-related behavioral outcomes such as exploratory behavior (Green & Campbell, 2000), affiliation (Gillath et al., 2017), and sex (Birnbaum et al., 2014; Gillath et al., 2008). Nevertheless, we were unable to estimate effect sizes for these behavioral outcomes due to the small number of studies on each outcome and, in some studies, our inability to extract data to conduct such analyses on these outcomes.

Fourth, a related limitation has to do with the coding of study outcomes in terms of the three major categories—namely—cognitive, affective, and behavioral outcome types. Although the majority of outcomes neatly fitted into one of the three categories, there were some outcomes that could be argued to fit into more than one category. For instance, we categorized self-esteem as a cognitive outcome as the assessment was attitudinal in nature, but we acknowledge that self-esteem has affective components. Similarly, we categorized empathy as an affective outcome as the empathy measures we analyzed mainly focused on the emotional aspects of empathy, but we acknowledge that empathy also entails cognitive aspects.

Third, in most studies (70%), supraliminal priming was used, with the majority of these studies using visualization or guided imagery stimuli/tasks. A large proportion of studies also compared security priming to a neutral or a control condition. Thus, the findings reported in this meta-analysis are largely confined to the effects of security priming within supraliminal studies using visualization/imagery methods of invoking security and comparing effects to control conditions.

Finally, evidence for the presence of publication bias was mixed. Analysis by way of publication status, the funnel plot, and the Trim and Fill method suggested the presence of publication bias. Based on the Trim and Fill method, publication bias varied across methodological aspects of studies, with subliminal studies demonstrating less evidence of publication bias than supraliminal studies and studies that used images or the names of attachment figures/close other demonstrating little evidence for bias. This variability in publication bias became even more varied when bias was examined at the level that paired outcomes with priming methods (see Table 4 and Supplement 1). It appears that studies designed with a focus on cognitive and affective outcomes that employed subliminal priming evidenced little publication bias, whereas studies that focused on the same outcomes but used supraliminal priming demonstrated evidence of bias.

However, it is important to note that these are the interpretations regarding publication bias that one can arrive at when solely focusing on methods designed to estimate asymmetry. Given that there are different strategies for detecting publication bias, it is increasingly recommended to assess for publication bias using multiple methods (e.g., B. T. Johnson, 2020; Kepes et al., 2012). In line with these recommendations, we also conducted a cumulative meta-analysis. In contrast to the results of the Funnel plot and Trim and Fill method, the cumulative meta-analysis demonstrated little evidence of publication bias. How do we reconcile these mixed findings regarding the possible presence of publication bias? Although the Funnel plot and the Trim and Fill method are some of the most widely used visual and statistical methods for determining the nature and impact of publication bias, under the random-effects model, tests of funnel plot asymmetry, like the Trim and Fill, cannot determine whether a given effect size is reflective of the presence of publication bias, or, the true effect (Borenstein et al., 2009). However, the cumulative analysis demonstrated that the effect size stabilized at a $d = .50$ with the inclusion of larger N studies and that the addition of smaller N studies did not result in any notable deviation of the point estimate. These findings suggest the true study effect (even in smaller studies; Borenstein et al., 2009) is in the range of $d = .48$ to .52. The cumulative analysis does, however, highlight that there is a likelihood that more than 65% of studies may be underpowered even to detect an effect size approximating $d = .50$. This has implications for considering the design of future studies on security priming.

Future Directions and Implications

The last 30 years have witnessed considerable research undertaken within the area of security priming. As evidenced by this meta-analysis, research to date has incorporated a variety of methods and tasks to prime attachment security and investigated a wide range of cognitive, affective, and behavioral outcomes. Our quantitative review of the area identified several lines of research within the field of security priming that deserve further attention.

First, and as already noted, more work is needed to determine the longitudinal effects of repeated security priming. We are aware of numerous research laboratories currently undertaking such work; thus, it may well be that in the not-too-distant future, the field will be in a position to draw firm conclusions on whether repeated security priming has long-term effects.

Second, there exists only a handful of security priming studies that focus on physiological outcomes and even less that focus on neuropsychological outcomes. Future research within these areas can help in understanding some of the psychophysiological and neuropsychological mechanisms of security priming and provide empirical evidence for the bio-behavioral benefits assumed to result from attachment security.

Third, further research is required to determine the effects of security priming when compared with positive and negative affective primes. Our findings are somewhat limited in this respect because of the small number of studies comprising affective primes. Therefore, future research should focus on incorporating such primes. Fourth, more studies are needed to unpack and better understand the moderating role of attachment style. The findings of this meta-analysis suggest that attachment style moderates the effects of security priming when priming is delivered subliminally and for behavioral outcomes. However, there is a need to replicate these findings using a larger pool of studies before reaching final conclusions.

Fifth, more research is needed on the impact of security priming on specific applied outcomes. For instance, although security priming was found to have the largest effect size for affective outcomes, only a small number of studies have investigated security priming effects on mental health outcomes of an affective nature such as depression or anxiety. It may well be that security priming can play an important role in enhancing the emotional well-being of people who experience affective disorders, but there is a need for more research to verify such assumptions. We, therefore, encourage researchers to investigate further the impact of security priming on mental health and the therapeutic relationship between therapist and client. Drawing on Bowlby's (1988) writings regarding the importance of the therapeutic relationship and attachment-informed therapies such as Emotionally Focused Couples Therapy (Johnson, 2019), it is evident that a key function of the therapist is to act as a secure base to enhance client feelings of felt security. Therefore, it may well be that security priming has an important role in fostering the therapeutic alliance.

One implication of the findings reviewed earlier is that priming could be easily done by exposing people to images or words or by having them list the names of their attachment figures. Importantly, priming (especially by way of images) does not have to be administered on a computer screen in a laboratory but rather can be embedded in one's environment. This can be done by way of signs, posters, or other visual material in community centers, college campuses, medical rooms, and hospitals (McGuire et al., 2018). Within the context of mental health, practitioners may be able to use priming stimuli by way of images in waiting rooms to enhance attachment security in their clients. Thus, priming attachment security through the use of images may be especially important in medical and mental health contexts where clients may already experience some anticipatory distress or trepidation before seeing a medical practitioner or mental health counselor. Exposure to such primes prior to therapeutic consultations may reduce distress and possibly attenuate defensive processes that may be activated (especially for those high in attachment avoidance) before or in-session when challenging or emotionally charged issues/problems need to be addressed. In this respect, the effects of the prime need not last for an extended period, merely long enough to facilitate some reductions in distress and defensiveness to enhance progress in-session and strengthen the therapeutic alliance.

Finally, our meta-analysis suggests a few recommendations for future studies. Drawing on our tests of asymmetry and publication status, it is possible to conclude that publication bias may be present. Specifically, studies that are most likely to exhibit bias are those that employ supraliminal priming and focus on effective outcomes. However, studies that employ subliminal priming methods and focus on either cognitive or behavioral outcomes appear to evidence little to no bias. In contrast to asymmetry tests and publication status, the cumulative analysis provided little evidence of publication bias and showed little deviation in the effect size, irrespective of sample size. That said, the majority of studies are likely to be underpowered.

If the true estimate of effect size is in the vicinity of .50, then for a between-groups study design (comprising two conditions), the sample size required to achieve adequate power would need to be in the range of 140 to 220 participants (70–110 per condition). If bias is indeed present, especially in studies using supraliminal priming with cognitive or behavioral outcomes, then the true effect may be as low as d =.17, in which case, a sample of 1,090 participants (i.e., 545 in each condition) would be required to achieve a power of .80.

For researchers interested in studying the effect of security priming, we recommend performing a power analysis while considering the outcome of interest, level of priming awareness, priming stimuli/task, and other design features such as comparison groups. To aid with decision-making regarding sample size requirements for particular study designs, we have developed an app that is freely available to all researchers wishing to conduct security priming studies (see https://www.scienceofadultrelationships.org/security-priming-study-sample-size-calculator).

Conclusion

Our findings suggest that security priming procedures can be effective in enhancing people's cognitive and behavioral functioning and especially affective outcomes. Furthermore, the findings suggest that when security priming is administered

subliminally, and the priming tasks involve the use of images, recalling the names of attachment figures, or exposure to security-enhancing words, the effects are larger in size and exhibit less evidence of publication bias. Finally, based on the findings regarding the use of different comparison priming conditions, security priming seems to result in effects that are distinct from those produced through the priming of positive affect.

Although the findings reviewed as part of this meta-analysis add to our understanding of security priming, they also raise further questions that require future research. Questions such as how do state security (primed) and trait security differ? How long can the effects of security priming last? What are the underlying psychophysiological and neurobiological substrates of attachment security? Can attachment security play a role in enhancing mental health and therapist-client relationship? Answering these questions will likely require taking a multilevel and multimethod approach to the study of security priming. Although costly and challenging, this kind of approach is likely to unlock a new era of important insights into the underlying mechanisms and processes that underpin attachment security.

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Supplemental Material

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Notes

1. We intended to analyze whether the number of priming sessions and the lag time between priming sessions moderated the effects of security priming over time. However, the reporting across studies did not commonly provide a clear description of priming frequency and lag. Given the small number of studies that assessed priming over time and the lack of clarity regarding security priming frequency and lag, we were unable to undertake these moderator analyses.
2. Number exceeds total studies as some investigated both positive and negative affect.
3. As noted in the main text, we grouped guided imaged, and visualization tasks together because both tasks pertain to focusing on imagery, with guided imagery being more structured in procedure than visualization. However, to ensure that these two forms of imagery did not differ in the moderating effects, we conducted separate moderation analyses for each. The effect sizes for the two imagery tasks/stimuli were similar in magnitude (guided imagery $d = .42$; visualization $d = .47$).
4. Mortality salience and insecurity prime comparison primes were combined as both prime types are reflective of the activation of a sense of threat and insecurity. Combining these prime types as part of the one category also increased the number of studies available to conduct a moderator analysis for these types of prime.
5. There are no explicit guidelines regarding what constitutes a study with a large sample size when conducting a cumulative meta-analysis; it very much depends on the nature of the study design, estimated effect sizes, and alike—features that can vary from meta-analysis to meta-analysis (Borenstein et al., 2009). In the case of this meta-analysis, we determined a large sample size to be reflective of any study that was powered at approximately .80 to detect an effect size of .50 (the magnitude at which the effect size stabilized). Our power estimate assumed an independent two-group design (the research design most used in the security priming studies included in the meta-analysis).
6. The moderating effects of attachment styles on behavioral outcomes for studies that employed a neutral/control priming condition were: attachment anxiety ($d = .48$, $p < .01$; 95% CI: [.14, .81], $k = 11$); attachment avoidance ($d = .18$, $p > .05$, 95% CI: [−.02, .37], $k = 11$). The 95% confidence intervals for these findings demonstrate overlap with the findings across all studies that included attachment styles as moderators when investigating behavioral outcomes (attachment anxiety [$d = .37$, 95% CI: [.04, .70], $p < .001$, $k = 14$]; attachment avoidance [$d = .18$, 95% CI: [.01, .36], $p < .05$, $k = 13$]).

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