Theoretical/Methodological/Review Article

Clinical Psychological Science
2024, Vol. 12(4) 721–750

DOI: 10.1177/21677026231190390
www.psychologicalscience.org/CPS

Self-Referential Processing and Depression: A Systematic Review and Meta-Analysis

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Abstract
Reward devaluation theory posits that depressed individuals avoid and devalue positivity, suggesting that they may hold fewer positive self-schemas. Previous meta-analytic reviews have supported this theoretical framework regarding positivity but have not assessed for self-referential stimuli. Self-referential encoding and recall tasks assess for self-schemas and thus provide further insight into how depressed individuals process self-referential positivity. The aim of this systematic review and meta-analysis was to examine the extent to which depressed individuals differ in processing self-referential positivity and negativity and whether this processing differs when depressed individuals think of others (i.e., other-referential). Results indicate that depressed individuals recall and endorse fewer self-referential positive words than negative words and fewer self-referential positive words than other-referential positive words than nondepressed individuals. These findings support reward devaluation theory and suggest that conceptualizing self-referential processing in depression as merely based on negativity biases can overlook crucial information about how depressed individuals devalue self-referential positive information.

Keywords
depression, self-reference, reward devaluation theory, memory bias, meta-analysis

Received 1/9/23; Revision accepted 6/13/23

Major depressive disorder (MDD) is a heterogeneous disorder that is estimated to have affected 4.4% of the world's population, or more than 300 million people (World Health Organization, 2017). Beck's cognitive model of depression posits that depressive symptoms are maintained by negative cognitions (Beck, 1967; Beck & Bredemeier, 2016). Schemas, or underlying semantic systems of beliefs or assumptions, about oneself and the world may contribute to how one interprets and recalls events. Nondepressed individuals tend to have positive beliefs about themselves (e.g., "I am good") and thus hold positive self-schemas; however, depressed individuals tend to have negative beliefs about themselves ("I am stupid") and thus hold negative self-schemas. Depressed individuals who hold negative self-schemas may more easily process incoming information in a negative fashion than nondepressed individuals. This negatively biased processing may result in an individual holding more negative expectations (and fewer positive expectations by default) and repeating the cycle just described.

Extant theories have suggested that depressed individuals experience less positivity primarily as an artifact of their heightened biases toward negativity (Beck & Bredemeier, 2016; Peckham et al., 2010); however, reduced experience of positivity by depressed persons may not merely be due to a focus on negativity. Reward devaluation theory (Winer & Salem, 2016) posits that depressed individuals do not simply lack bias toward positive information but that they actually avoid experiencing positivity (Pool et al., 2016). This may be due to previous positive experiences being met with negative outcomes, including disappointment. Emerging evidence supports this claim. Meta-analytic findings have demonstrated that depressed individuals avoid positive information on the dot-probe task (Winer & Salem, 2016) and are more likely to have previously

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relinquished positivity (Winer et al., 2017) than nondepressed individuals.

Depressed individuals' engagement in avoidant tendencies or dampening in response to positive information is likely associated with less positive self-schemas independent of their in-the-moment processing of negative information compared with nondepressed individuals (e.g., "I deserve not to be happy"; Collins et al., 2023; Gilbert et al., 2012; Joshanloo, 2013; Raes et al., 2012; Winer & Salem, 2016). Indeed, recent findings from a network analysis suggest that depressed individuals with negative self-views are more likely to engage in rumination and devalue positivity, thus providing more evidence that they hold not only more densely connected negative self-schemas but also more devaluative positive self-schemas (Collins et al., 2021).

Although depressed individuals robustly avoid positive information (Winer & Salem, 2016), avoidance may emerge in particular in response to self-referential positive information compared with nonreferential positive information (Ji et al., 2017). Investigating how depressed individuals process self-referential versus other-referential positive information can thus provide crucial information on the extent to which positive self-schemas, specifically, influence the development and maintenance of depressive symptoms (Everaert et al., 2017; Matt et al., 1992; Wisco, 2009).

Self-Referential Processing Tasks

Prior studies have examined the self-schemas of individuals with depressive symptoms with the self-referent encoding task (SRET): a cognitive task that assesses cognitive self-schemas and self-referential information processing (Derry & Kuiper, 1981). In this task, participants are presented with various adjectives and asked to decide (i.e., "yes" or "no") whether the word presented is applicable to the prompt.

There are two different conditions that may be included in this task: self- and other-referential.[1] In the self-referential condition, the prompt "Describes me?" appears, and participants must decide whether the presented word describes them. In the other-referential condition, the prompt "Describes XXX?" appears, and participants must decide whether the presented word describes the "other" subject. Previous studies have included the other subject to be a closely known person (i.e., familiar-other condition), including their best friend and the current president at the time (Bradley & Mathews, 1983; Shestyuk & Deldin, 2010), or general others whom they are relatively unfamiliar with (i.e., unfamiliar-other condition), including the mail person.[2]

Many researchers who have used the SRET have included a recall task after completion of the endorsement portion. Whereas some studies have had participants complete the recall task immediately, many studies have included a distractor task (e.g., a digit-span task; Gotlib et al., 2004) and have had participants complete the recall task afterward. In addition, researchers have varied the amount of time given to recall the words, ranging from a specific time frame for recall (e.g., 3 min) to unlimited time.

SRET metrics

The main dependent variables that assess processing of self-referential information in the SRET are (a) endorsement, (b) recall, and (c) reaction time (RT; for a comprehensive review of these variables, see Dainer-Best, Lee, et al., 2018). Endorsement is operationalized by counting the number of times an individual selects "yes" to a word in the valence category (e.g., positive or negative). Higher endorsement scores in a valence for self-referential words reflect a greater degree of endorsing the respective valence category as self-referential. Recall is operationalized by dividing the number of previously endorsed words that are correctly recalled by the total number of words endorsed. This recall metric is calculated for each valence independently. Higher scores in a valence category reflect better recall for words of that respective valence. RT is operationalized as the mean latency taken to answer yes or no. This metric can be calculated for each valence and decision (i.e., yes and no) independently.

We here describe extant findings for self-referential processing and depression. We begin by outlining the findings at the within-subjects level for endorsement, recall, and RT. We then outline similar findings at the between-subjects level, including separate findings for self-referential positivity and negativity. Finally, we outline findings comparing self- with other-referential processing for positivity and negativity.

Self-referential processing and depression

Within-subjects findings. Prior research has emphasized the role of negative self-schemas and has thus paid less attention to positive self-schemas. Moreover, few studies have examined potential differences within depressed individuals of processing positive and negative self-referential information.

Endorsement. An overall mixed pattern of findings emerges regarding how depressed individuals differ in the endorsement of valanced self-referential words. Specifically, there is evidence in the literature supporting the idea that depressed individuals (a) endorse more negative words (Dainer-Best et al., 2017), (b) endorse more positive words (Disner et al., 2017), or (c) have no differences in the endorsement of positive and negative words (Kiang

et al., 2017). Moreover, many studies have not reported any potential differences in endorsement within depressed individuals and included only means and standard deviations in a table. These mixed findings differ starkly from the pattern of findings regarding how nondepressed individuals endorse valanced self-referential words because nondepressed individuals endorse more positive words. To our knowledge, all studies in the literature point to nondepressed individuals endorsing more positive words than negative words (Dainer-Best et al., 2017).

Given the mixed findings for depressed individuals, the sparseness of data within the literature (e.g., many studies reporting only descriptives) for depressed individuals, and the clear findings regarding nondepressed individuals, a more detailed investigation into how depressed individuals endorse valenced self-referential words is warranted. Moreover, it is unclear whether depressed individuals will demonstrate a clear pattern for the endorsement of a particular valence, as seen for nondepressed individuals in the literature.

Recall. Unlike for endorsement, a clearer pattern emerges for recall of self-referential words in depressed individuals. Specifically, the literature indicates that depressed individuals recall more negative self-referential words than positive words (Fritzsche et al., 2013); however, some studies have indicated no differences in the recall of valanced words (Disner et al., 2017), and a few studies have not reported any potential differences in recall within depressed individuals and included only means and standard deviations in a table. In contrast, a clear pattern does emerge for nondepressed individuals: They recall more positive self-referential words than negative self-referential words (Dainer-Best et al., 2017). Thus, an investigation of potential differences in the recall of valenced words in depressed individuals is warranted to determine whether a clear pattern emerges for depressed individuals, as it does for nondepressed individuals.

RT. The speed at which individuals respond when making decisions on whether a word describes them and how they differ in their RTs for positive and negative self-referential words are unknown for both depressed and nondepressed individuals. The literature regarding within-subjects RTs is largely mixed; many studies have demonstrated that there are no differences regarding the speed in which depressed individuals or nondepressed individuals differ in their RTs (Dainer-Best, Lee, et al., 2018). Thus, a further investigation into how depressed and nondepressed individuals may differ in RTs for positive and negative words is warranted.

In sum, given the mixed findings and lack of explicit discussion of within-subjects differences stated for endorsement, recall, and RT, the extent to which depressed individuals differ in processing positive and negative self-referential stimuli is currently unknown. This is a particularly important area of research to explore further to better understand how depressed individuals may organize their self-schemas.

Between-subjects findings for depressed versus nondepressed individuals.

Endorsement. Several studies have found that depressed individuals hold stronger negative schemas and weaker positive schemas. In comparison, nondepressed individuals have weaker negative schema and stronger positive schemas. Indeed, when comparing these two groups, researchers have found that depressed individuals are more likely to endorse more negative words and fewer positive words as self-referential than nondepressed individuals (Sarsam et al., 2013), suggesting negative self-schemas are stronger in depressed individuals. However, the extent to which individual differences (e.g., depressive-symptoms severity) may influence negative and positive self-schemas has not been fully explored.

Recall. Similar patterns of endorsement are found when examining recall: Depressed individuals recall more negative words and fewer positive words than nondepressed individuals (Fritzsche et al., 2013). However, this pattern is not as clear as the pattern seen with endorsement because some research suggests that there are no differences in recall of negative and positive words between depressed and nondepressed individuals (Shestyuk & Deldin, 2010; Toner et al., 1990). Thus, the mixed findings warrant a further investigation to determine whether there are differences in recall of negative and positive information between depressed and nondepressed individuals.

RT. The literature regarding RTs is largely mixed. Although a pattern has emerged such that depressed individuals tend to have slower RTs than nondepressed individuals, requiring more time to make decisions on whether words are self-referential (Fritzsche et al., 2013), some studies have found no differences between depressed and nondepressed individuals (Dainer-Best et al., 2017). Moreover, the extent to which depressed and depressed individuals differ on their RTs to specific valanced self-referential words is not clear. Thus, a more detailed investigation of whether RTs differ between depressed and nondepressed is warranted.

Self- versus other-referential processing for depressed individuals

As noted above, depressed individuals may specifically process positivity in a devaluative manner for self-referential information only and not for other-referential information (Ji et al., 2017). Previous meta-analyses

have indicated that self-referential processing results in greater memory recall than other-referential and semantic processing (Symons & Johnson, 1997) and that self-referential stimuli elicit stronger biases than nonreferential stimuli in depressed individuals (Everaert et al., 2017). This is consistent with theories suggesting that information related to depressed individuals' self-schemas (i.e., self-referential words) elicit stronger biases than information not related to their self-schemas (i.e., other-referential or semantic words; Clark et al., 1999). However, neither of these meta-analyses examined the potential differences in self- and other-referential processing of valanced words.

Despite the potential clinical importance of understanding how depressed individuals differ in processing self- and other-referential information (and how this differs from nondepressed individuals), little research has examined these differences with the SRET. Indeed, studies that have examined within-subjects self- and other-processing often do not report findings between self- and other-stimuli. For example, many studies have not reported any potential differences in endorsement, recall, or RT within depressed individuals regarding other-referential processing and included only means and standard deviations in a table. Moreover, it is unclear how depressed individuals differ in processing self- and other-referential information when making decisions about familiar others (e.g., family members) and unfamiliar others (e.g., the mail person). Thus, given that there are limited findings for within-subjects other-referential analyses, including that several studies have reported only means and standard deviations, a further investigation of potential differences between self- and other-referential words is warranted to provide insight into how depressed individuals differ in their processing of self and other information.

The differences between self- and other-referential processing between depressed and nondepressed individuals have also not been extensively investigated. Prior research suggests that both depressed and nondepressed individuals endorse and recall more words as self-referential than other-referential (Dalgleish et al., 2004); however, it is unclear how depressed and nondepressed individuals differ in their endorsement and recall of other-referential words when considering valence. Moreover, fewer studies have examined differences of RTs between self- and other-referential words. Given the limited findings regarding between-subjects differences of other-referential processing, a further investigation into how depressed and nondepressed individuals differ is warranted.

Rationale

To our knowledge, only one meta-analysis has focused exclusively on this task; however, it examined memory differences between self-, semantic-, and other-referential encoding strategies; did not examine the role of depressive symptoms; and was conducted approximately 25 years ago (Symons & Johnson, 1997). Other meta-analyses have included this task; however, they examined interpretation biases overall and are thus not exclusive to self-referential encoding and recall (Everaert et al., 2017; Matt et al., 1992).

A recent systematic review of memory bias in mood disorders suggested that depressed individuals exhibit a general memory impairment compared with control subjects (Bogie et al., 2019). The authors concluded that there was not an emotional memory bias for depressed individuals and noted that there were large differences in the time frame between the endorsement task and recall, ranging from a few minutes to a day. The review included only 10 studies because of inclusion criteria requiring participants to be diagnosed by a standardized assessment tool (and not a self-report measure). In addition, studies with differing stimuli and tasks for the initial task before the recall were included together. For example, the review included studies with imagery in response to words, endorsement of words, rating of words on a Likert scale, and rating of emotional intensity of images. Moreover, even a cursory review of a wider range of self-referential endorsement findings suggests that there may be valence-based differences.

The most relevant investigation to our research question includes a meta-analysis that examined memory biases in depressed individuals (Everaert et al., 2022). Previous literature reviews have emphasized the role of negative biases (Beevers, 2005; Gotlib & Joormann, 2010; Kircanski et al., 2012) or a negative self-referential bias (Wisco, 2009) on depressive symptoms. Specifically, depressed individuals endorse more negative words as self-referential and recall more negative words than nondepressed individuals. However, the findings from this recent meta-analysis demonstrated larger effect sizes for a reduced positive memory bias than greater negative bias, thus emphasizing further investigations of how depressed individuals process positivity and negativity (Everaert et al., 2022). In addition, Everaert et al.'s (2022) examination of depth of processing as a moderator indicated that stronger memory bias was found in tasks that required self-referential processing, providing further evidence of the importance of self-reference in depression. However, the extent to which

self-referential processing differs in the domain of valence was not examined, and the role that self-referential processing plays in endorsement and reaction time is unclear.

Thus, one aim of this meta-analysis is to examine the extent to which depressed individuals differ in processing self-referential positivity and negativity, including within-subjects and between-subjects differences, compared with nondepressed individuals. Moreover, how these prospective differences emerge when comparing self-referential and other-referential processing is unclear, particularly when considering valence. Thus, the aim of the current project was to conduct a systematic meta-analysis to examine the extent to which depressed individuals differ in processing self-referential positivity and negativity compared with other-referential information and nondepressed individuals.

Hypotheses

We examined self- and other-referential endorsement and recall of positive and negative adjectives to investigate whether differences emerged within depressed individuals and between depressed and nondepressed individuals. Because of the limited number of self-versus other-referential comparisons, differences between these two conditions were investigated via exploratory analyses. We also investigated RT; however, RT differences were investigated via exploratory analyses because the literature is largely mixed.

We predicted the following:

Hypothesis 1: Depressed individuals will endorse fewer positive words than negative words as self-descriptive, and this will be a medium-sized effect (e.g., Dainer-Best et al., 2017).

Hypothesis 2: Depressed individuals will recall fewer self-referential positive words than self-referential negative words.

Hypothesis 3: Depressed individuals will endorse fewer positive words as self-descriptive than nondepressed individuals, and this will be a large-sized effect (Dainer-Best et al., 2017).

Hypothesis 4: Depressed individuals will recall fewer self-referential positive words than nondepressed individuals, and this will be a large-sized effect (e.g., Romero et al., 2016).

Hypothesis 5: Depressed individuals will endorse more negative words as self-descriptive than nondepressed individuals, and this will be a large-sized effect (e.g., Dainer-Best et al., 2017).

Hypothesis 6: Depressed individuals will recall more self-referential negative words than nondepressed individuals, and this will be a large-sized effect (e.g., Romero et al., 2016).

Method

Transparency and openness

We adhered to the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P; Moher et al., 2015; Shamseer et al., 2015). For the PRISMA-P checklist for this document, see Table S1 in the Supplemental Material available online. Data were modeled using Comprehensive Meta-Analysis Version 3 (Borenstein et al., 2021). All data and research materials are available at https://osf.io/b9a8t/.

Before conducting the current project, we conducted two separate searches on PROSPERO on May 3, 2021, to ensure that there were no other registrations that were similar to the current project. Our searches including the following keywords: "self-referent" and "memory bias" and "SRET." Twenty-one registrations were returned, and no registrations examined self-referential processing in relation to depressed individuals. Core details of the current project were registered and can be accessed on PROSPERO.[3] We recommend that readers view the PROPSERO registration for February 11, 2022, to view our registration before analyses; however, we have included several in-text and footnote statements regarding any procedures or details that deviate from those outlined in the PROSPERO registration.

Search strategy

We searched PsycINFO with the following keywords: (a) depress* AND ("self-referen*" OR "memory bias" OR "SRET" OR "self-incidental" OR "self-incid*" OR "encode"), (b) positive* AND ("self-referen*" OR "memory bias" OR "SRET" OR "self-incidental" OR "self-incid*" OR "encode"), (c) "reward devaluation" AND ("self-referen*" OR "memory bias" OR "SRET" OR "self-incidental" OR "self-incid*" OR "encode"), and (d) dys* AND ("self-referen*" OR "memory bias" OR "SRET" OR "self-incidental" OR "self-incid*" OR "encode").

Literature search

Results from a literature search on PsycINFO include peer-reviewed articles that were published before April 1, 2021. For keywords used in our search, see the Supplemental Material. In addition, we searched the reference lists of relevant review articles and meta-analyses to verify that all relevant articles to our research questions were included (Everaert et al., 2017; Matt et al., 1992; Symons & Johnson, 1997; Wisco, 2009). For

studies that provided incomplete data for meta-analyses (e.g., means included but not standard deviations) and were published within the last 20 years, we contacted the corresponding authors via email to obtain the data needed for our analyses. We contacted three authors and did not receive additional data for any of these studies.

Study selection

The PRISMA flow diagram in Figure S1 in the Supplemental Material demonstrates the literature-search and study-selection process. A. C. Collins compiled a list of potential studies to be included that met the inclusion criteria discussed above. A. C. Collins and E. S. Winer then reviewed the list of potential studies to be included and reached consensus on all studies included in the analysis.[4]

Inclusion/exclusion criteria

We included studies in the systematic review and meta-analysis using the following inclusion criteria.

Study design. We included studies that used the SRET (Derry & Kuiper, 1981) or some variation of this task. The stimuli in each study consisted solely of words (i.e., no images or images with words). Sentences or sentence-completion stimuli were not included because of the differences in processing single words versus sentences (e.g., RT). Studies that asked participants to rate the adjectives were not included (i.e., rating on a scale from 1 to 5 how self-descriptive the given adjective is).[5] We also did not include studies that investigated only the SRET after a mood induction or treatment because we were interested in baseline processing (i.e., not changes after an induction or treatment). In addition, positive words must have been included in the task. This includes words that are characterized as "nondepressed." Studies that did not include positive words for the SRET were not included.[6]

Participants. We included studies with adult participants between the ages of 18 and 65. In addition, studies were included if they had a group of depressed individuals as measured by self-report instruments (e.g., the Beck Depressive Inventory [BDI]) or diagnostic interview (e.g., the Structured Clinical Interview for DSM-5 [SCID]) or as indicated by chart-review diagnoses. We included studies with nondepressed individuals if there was also a depressed group, as noted previously. Studies were excluded if (a) depressive symptoms were not reported, (b) the primary diagnosis of the clinical group was a diagnosis other than depression (e.g., schizophrenia), and (c) participants had a brain injury or neurological or developmental disorder.

Data items

The following variables were acquired from each study to be included in the systematic review and meta-analysis and recorded in Excel and Comprehensive Meta-Analysis documents: (a) study year; (b) authors; (c) hypotheses; (d) sample size, including group conditions and number of participants in each group; (e) recruitment sites (e.g., university, academic medical center); (f) participants' characteristics, including depressive symptoms, diagnoses, age, and gender; (g) participants' prescreen requirements and assessments used (e.g., the SCID); (h) stimulus duration; (i) trial prompts; (j) number of trials; (k) valence of stimuli; (l) word lists for stimuli; (m) task name; (n) recall procedure; (o) study/analysis design; (p) results, including means, standard deviations, and effect sizes; (q) referential condition (i.e., self vs. other); (r) abstract; and (s) quoted text to describe both within- and between-subjects results.

Outcome variables

Our outcome measures were the means and standard deviations of endorsement, recall, and RT of positive and negative words as self-referent and other-referent. However, we were primarily interested in the processing (e.g., endorsement and recall) of self-referential positive words and included the negative-valence and other-referential conditions as comparisons. If means and standard deviations were unavailable, other representative effects were used, as available. For studies that did not include means and standard deviations, we included t values in our analyses. If studies did not include means and standard deviations or t values, then we included r values in our analyses. These outcome measures allowed us to calculate the respective effect sizes and examine our research questions described above.

For studies that included multiple categories of the same valence, we combined the means and standard deviations to create an overall valence score (e.g., positive or negative).[7] For example, Pincus et al. (1995) included three categories of positive and negative words each. We averaged the means and standard deviations for the three conditions to create overall positive and negative scores for endorsement and recall. For studies that included two groups with depressive symptoms (e.g., Bradley & Mathews, 1983), we split the control-group sample size in half to compare both clinical groups against the control group, as done in previous meta-analyses (Bar-Haim et al., 2007; Winer & Salem, 2016).

Strategy for data synthesis

The intention of this systematic review was to conduct meta-analyses to examine our six research questions using comprehensive meta-analysis (Borenstein et al., 2021). We computed effect sizes (as measured by Hedges's *g*) for within- and between-groups differences using the means, standard deviations, and sample sizes or other representative statistics noted above (i.e., *r* values and *t* values) for each of the studies included in the meta-analyses respective to each research question. Hedges's *g* is commonly used for meta-analyses and provides a better estimate of effect sizes for studies with smaller sample sizes (Hedges & Olkin, 1984). For Hedges's *g*, a small effect size may be approximated at 0.2, a medium effect size may be approximated at 0.5, and a large effect size may be approximated at 0.8 or above.

Exploratory moderator analyses were not preregistered and included (a) depressive-symptom severity (e.g., mildly depressed vs. severely depressed) to examine the effect of severity of depressive symptoms on our outcome variables and (b) clinical status (i.e., clinical vs. nonclinical) to examine the effect of diagnosis on our outcome variables. Depressive-symptom severity was treated as a categorical moderator, and we used previously established cutoff scores for the BDI (Beck et al., 1998), Center for Epidemiological Studies for Depression Scale (Weissman et al., 1977), and Hamilton Depression Rating Scale (Zimmerman et al., 2013) to categorize the overall average depressive severity for each sample as minimal, mild, moderate, or severe.[8]

In addition, we used the I^2 statistic, which reveals how much the percentage of variance of an effect is due to heterogeneity across studies, to assess whether further moderator analyses were warranted (Higgins et al., 2003). As done in previous work (Liu, Bettis, & Burke, 2020; Liu, Steele, et al., 2020), we conducted additional moderator analyses to examine potential causes of heterogeneity (i.e., age of depressed group, gender [% female] of depressed group, recall delay [in minutes], and study bias) when our results suggested significant heterogeneity.

Risk-of-bias assessment

To assess for risk of bias (ROB) of individual studies, we used the robvis visualization tool (McGuinness & Higgins, 2020).[9] We specifically used the template for the ROBINS-I tool, which assesses for ROB for nonrandomized studies of interventions (Sterne et al., 2016) and is commonly used in systematic review and meta-analyses. As done in a recent meta-analysis (Nikolin et al., 2021), we did not use two domains (bias in classification of interventions and bias because of deviations from intended interventions) because they are related to biases that may occur when classification of an intervention status is related to the outcome measure or when there are differences in how an intervention was implemented. Thus, these domains are not applicable to the current meta-analysis because we were not looking at outcomes from an intervention.

We used the R package *robvis* to create a ROB plot following the ROBINS-I tool. This package creates a visual traffic-light plot of studies and ROB domains using the *rob_traffic_light()* function. We created two legends to assist in interpreting the plot. First, we created a legend to describe the different domains that each study was judged on for bias (e.g., one domain is "bias due to missing data"). Second, we created a legend to demonstrate the color scheme for each judgment of bias. We used the *rob_summary()* function to create a weighted bar plot that shows the proportion of judgment bias for each domain.

Publication bias

We also assessed for publication bias, which we did not preregister on PROSPERO, and we used several procedures: First, we used Duval and Tweedie's trim and fill to assess for the number of potential missing studies, which is calculated from the asymmetry in the given funnel plot (Duval & Tweedie, 2000). Then, an adjusted effect size is provided based on the missing studies. Second, we used fail-safe *N* (or the file-drawer analysis), which estimates the number of nonpublished studies that would be needed to reduce a given effect size to a nonsignificant value (Rosenthal, 1979). Third, we used Egger's test of the intercept (Egger et al., 1997), which assesses the asymmetry of a given funnel plot on the basis of a linear regression method.

Results

An initial literature search through PsycINFO revealed 3,055 potential reports to be included in our meta-analyses. Following the identification and screening methods in the PRIMSA flow diagram, we identified 26 reports that met our eligibility criteria. Moreover, some reports included multiple studies or unique samples, resulting in 31 studies and/or samples that met our eligibility criteria.[10] For the samples included in the current meta-analyses, see Table S2 in the Supplemental Material. In addition, three studies were identified that had overlapping samples with other studies; whenever studies with overlap were identified, we included only one study that best matched the data availability and

Table 1. Within-Subjects Self-Referential Processing Meta-Analytic Results for Depressed Individuals

	k	*n*	*g*	*SE*	I^2	T^2	Q	*b*	*p*
				Endorsement					
All studies	21	640	−0.019	0.129	97.617	0.334			.884
Clinical status	21	640					1.210		.271
Clinical	16	470	−0.112	0.142					.428
Nonclinical	5	170	0.291	0.338					.390
Severity	21	640					2.797		.247
Mild	2	35	1.243	1.084					.252
Moderate	11	300	−0.032	0.237					.892
Severe	8	305	−0.283	0.104					.007
Age (continuous)	20	633		0.018				0.025	.163
Gender (continuous)	19	592		0.779				−0.414	.595
Risk of bias	21	640					1.525		.217
Low	17	544	0.031	0.152					.840
Moderate	3	96	−0.284	0.205					.166
				Recall					
All studies	20	504	−0.156	0.077	92.432	0.105			.043
Clinical status	20	504					0.017		.896
Clinical	15	448	−0.162	0.089					.070
Nonclinical	5	56	−0.138	0.159					.386
Severity	20	504					4.144		.126
Mild	5	79	−0.053	0.113					.639
Moderate	11	253	−0.128	0.123					.299
Severe	4	172	−0.346	0.100					.001
Age (continuous)	20	504		0.100				0.011	.282
Gender (continuous)	19	480		0.478				−0458	.337
Recall delay (continuous)	20	504		0.029				−0.024	.401
Risk of bias	20	504						0.216	.642
Low	17	483	−0.140	0.084					.095
Moderate	3	21	−0.256	0.236					.275

Note: Positive Hedges's *g* indicates bias for positive words; negative Hedges's *g* indicates bias for negative words.

criteria for our analyses. For a list of studies that used the SRET with depressed individuals that were excluded because of stimuli, previously reported data, and insufficient description of results, see Table S3 in the Supplemental Material.

Meta-analysis of within-subjects biases for self-referential information

For all within-subjects analysis, a positive Hedges's *g* indicates a bias for positive information (e.g., greater endorsement of positive words than negative words). A negative Hedges's *g* indicates a bias for negative information (e.g., greater endorsement of negative words than positive words). Because of manuscript-length constraints, we included the results from the moderator analyses in the Supplemental Material. For the results of within-subjects self-referential meta-analyses for depressed individuals, see Table 1. For the results of within-subjects self-referential meta-analyses for nondepressed individuals, see Table S4 in the Supplemental Material.

Endorsement. Twenty-one samples were included in our meta-analysis of within-subjects self-referential endorsement for depressed individuals. The combined effect size was not significant ($k = 21$, $n = 640$, $g = -0.019$, $SE = 0.129$, $p = .884$; see Fig. 1). Thus, our first hypothesis was not supported: There were no significant differences between the endorsement of self-referential positive stimuli and negative stimuli for depressed individuals.

Our within-subjects self-referential endorsement results for nondepressed individuals revealed a clearer pattern, and 15 samples were included in our meta-analysis of within-subjects self-referential endorsement for nondepressed individuals.[11] The combined effect size was large, positive, and significant ($k = 15$, $n = 332$, $g = 4.376$, $SE = 0.471$, $I^2 = 98.070$, $T^2 = 3.203$, $p < .001$;

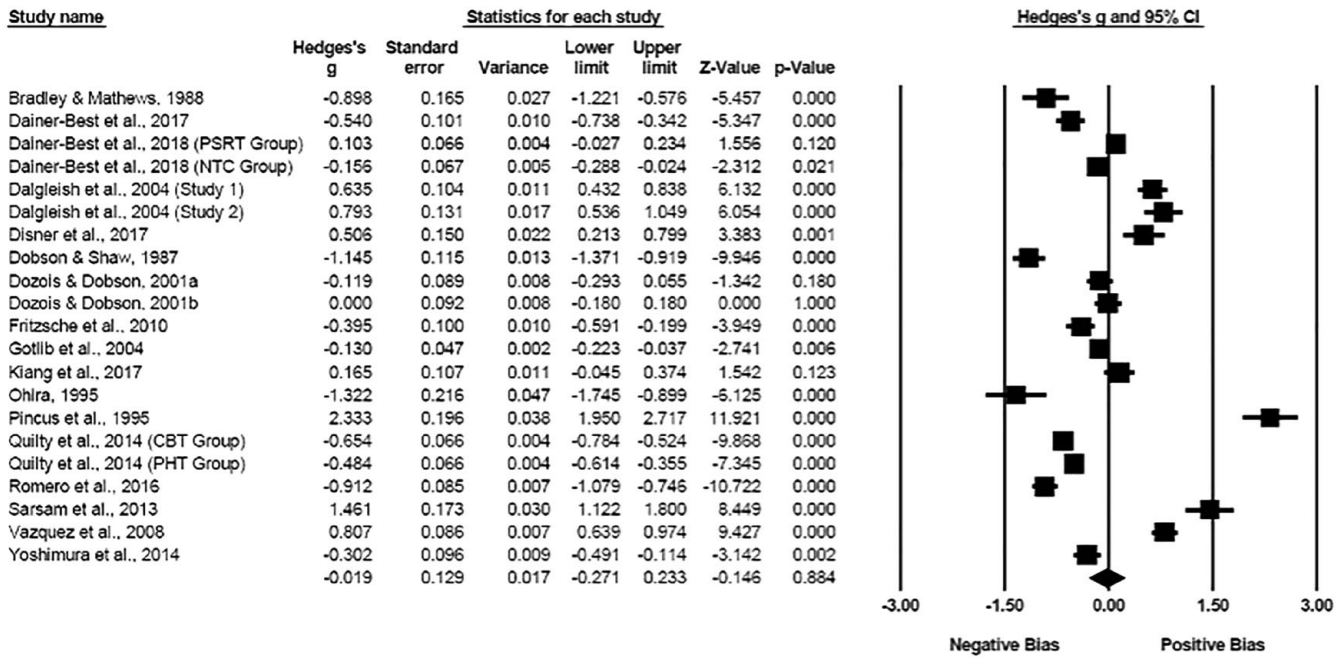

Fig. 1. Endorsement of self-referential words for depressed individuals (within-subjects). Bottom line of each analysis indicates the statistics for the combined effect size.

see Fig. S2 in the Supplemental Material). Nondepressed individuals across all samples endorsed more self-referential positive words than negative words.

We conducted moderator analyses for the within-subjects endorsement for depressed individuals with the within-subjects analysis for depressed individuals. We included clinical status (i.e., nonclinical vs. clinical) and depressive-symptom severity as categorical variables (i.e., mild vs. moderate vs. severe; see Table 1).[12,13] The combined between-subjects effect size was not significant for either the clinical group (k = 16, n = 470, g = −0.112, SE = 0.142, p = .428) or the nonclinical group (k = 5, n = 170, g = 0.291, SE = 0.338, p = .390). There were no significant differences between the two groups (Q = 1.210, p = .271). The combined between-subjects effect size was significant for the severe group (k = 8, n = 305, g = −0.283, SE = 0.104, p = .007) but not for the mild group (k = 2, n = 35, g = 1.243, SE = 1.084, p = .252) or the moderate group (k = 11, n = 300, g = −0.032, SE = 0.237, p = .892). There were no significant differences between the three groups (Q = 2.797, p = .247). Thus, although the overall difference was not significant, individuals who endorsed only severe levels of depressive symptoms and not mild or moderate depressive symptoms endorsed fewer positive words than negative words as self-referential. Despite these differences between groups occurring in our predicted direction (i.e., severely depressed individuals significantly endorsed more negative stimuli than positive stimuli), clinical status did not emerge as a significant moderator.

Our results from the within-subjects analysis for depressed individuals suggested significant heterogeneity (I^2 = 97.617, T^2 = 0.334), so we also conducted moderator analyses for age and gender as continuous variables and ROB as a categorical variable. Neither age (b = 0.025, p = .163) nor gender (b = −0.414, p = .595) emerged as significant moderators. The combined between-subjects effect size was not significant for the low-ROB group (k = 18, n = 544, g = 0.031, SE = 0.152, p = .840) nor the moderate-ROB group (k = 3, n = 96, g = −0.284, SE = 0.205, p = .166). The difference between the two groups was not significant (Q = 1.525, p = .217). Thus, age, gender, and ROB did not affect these findings.

Our findings indicate some evidence of publication bias in the within-subjects analysis for depressed individuals. The Duval and Tweedie's trim-and-fill analysis indicated that there were three studies missing that had effect sizes above the mean (for the funnel plot, see Fig. S3 in the Supplemental Material). The overall effect size remained small after removing these three studies using the trim-and-fill analysis (g = −0.02). In addition, the results from the fail-safe N indicate that we would need 82 studies to "nullify" the observed effect size (z = −4.33, p < .001). The results from the Egger's test indicated that there was no evidence of publication bias (SE = 3.97, p = .27).

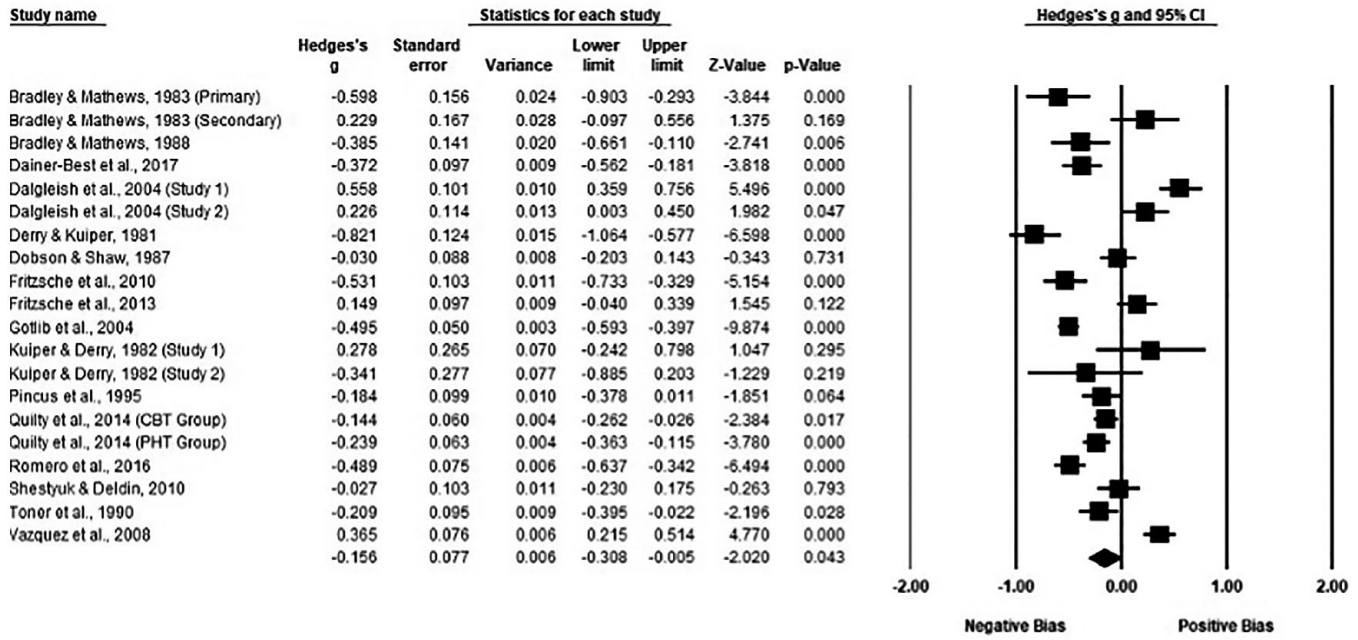

Fig. 2. Recall of self-referential words for depressed individuals with studies excluded (within-subjects). Bottom line of each analysis indicates the statistics for the combined effect size.

Recall. Twenty samples were included in our meta-analysis of within-subjects self-referential recall for depressed individuals.[14] The combined effect size was small, negative, and significant (k = 20, n = 504, g = −0.156, SE = 0.077, p = .043; see Fig. 2 in the Supplemental Material). Thus, our second hypothesis was supported with a small-sized effect: Depressed individuals across all samples recalled more self-referential negative words than positive words.

We found an opposite pattern for the within-subjects self-referential recall findings for nondepressed individuals, and 15 samples were included in our meta-analysis. The combined effect size was large, positive, and significant (k = 15, n = 347, g = 2.440, SE = 0.305, I^2 = 96.729, T^2 = 1.302, p < .001; see Fig. S4 in the Supplemental Material). Nondepressed individuals across all samples recalled more self-referential positive words than negative words.

We conducted moderator analyses for the within-subjects recall for depressed individuals. We included clinical status and depressive-symptom severity as categorical variables after excluding the two stables (see Table 1). The combined between-subjects effect size was not significant for either the clinical group (k = 15, n = 448, g = −0.162, SE = 0.089, p = .070) or the nonclinical group (k = 5, n = 56, g = −0.138, SE = 0.159, p = .386). The difference between the two groups was not significant (Q = 0.017, p = .896). Thus, clinical-group status did not affect these findings. The combined between-subjects effect size was significant for the severe group (k = 4, n = 172, g = −0.346, SE = 0.100, p = .001) but not for the mild group (k = 5, n = 79, g = −0.053, SE = 0.113, p = .639) or the moderate group (k = 11, n = 253, g = −0.128, SE = 0.123, p = .299). The difference between the three groups was not significant (Q = 4.144, p = .126). Thus, although the overall difference was not significant, individuals who endorsed only severe levels of depressive symptoms recalled more self-referential negative words than positive words.

Our results from the within-subjects analysis for depressed individuals suggested significant heterogeneity (I^2 = 92.432, T^2 = 0.105), so we also conducted moderator analyses for age, gender, and recall delay as continuous variables and ROB as a categorical variable after excluding the two studies. Neither age (b = 0.011, p = .282), gender (b = −0.458, p = .337), nor recall delay emerged as significant moderators (b = −0.024, p = .401). The combined between-subjects effect size was not significant for the low-ROB group (k = 17, n = 483, g = −0.140, SE = 0.084, p = .095) or the moderate-ROB group (k = 3, n = 21, g = −0.256, SE = 0.236, p = .275). The difference between the two groups was not significant (Q = 0.216, p = .642). Thus, age, gender, recall delay, and ROB did not affect these findings.

Our findings indicate no evidence of publication bias in the within-subjects analysis for depressed individuals. The Duval and Tweedie's trim-and-fill analysis

indicated that there were no studies missing that had effect sizes below or above the mean (for the funnel plot, see Fig. S5 in the Supplemental Material). In addition, the results from the fail-safe *N* indicate that we would need 288 studies to nullify the observed effect size ($z = -7.68$, $p < .001$). The results from the Egger's test also indicated that there was no evidence of publication bias ($SE = 2.25$, $p = .45$).

RT. Fifteen samples were included in our meta-analysis of within-subjects self-referential RTs for depressed individuals. The combined effect size was not significant ($k = 15$, $n = 437$, $g = -0.017$, $SE = 0.045$, $p = .707$; see Fig. S6 in the Supplemental Material). These results suggest that there were no significant differences between the RTs of positive self-referential words and negative self-referential words for depressed individuals.

Our findings regarding the within-subjects self-referential RTs demonstrated a similar pattern, and 10 samples were included in our meta-analysis. The combined effect size was not significant ($k = 10$, $n = 203$, $g = 0.103$, $SE = 0.068$, $I^2 = 78.487$, $T^2 = 0.035$, $p = .128$; see Fig. S7 in the Supplemental Material). These results suggest that there were no significant differences between the RTs of positive self-referential words and negative self-referential words for nondepressed individuals.

We conducted moderator analyses for the within-subjects RT for depressed individuals. We included clinical status and depressive-symptom severity as categorical variables after excluding the two stables (see Table S5 in the Supplemental Material). The combined between-subjects effect size was not significant for either the clinical group ($k = 10$, $n = 332$, $g = -0.060$, $SE = 0.057$, $p = .292$) or the nonclinical group ($k = 5$, $n = 105$, $g = 0.073$, $SE = 0.063$, $p = .249$). The difference between the two groups was not significant ($Q = 2.443$, $p = .118$). The combined between-subjects effect size was not significant for either the severe group ($k = 6$, $n = 274$, $g = 0.011$, $SE = 0.027$, $p = .695$) or the moderate group ($k = 9$, $n = 163$, $g = -0.031$, $SE = 0.085$, $p = .712$). The difference between the two groups was not significant ($Q = 0.222$, $p = .638$). Thus, clinical-group status and symptom severity did not affect these findings.

Our results from the within-subjects analysis for depressed individuals suggested significant heterogeneity ($I^2 = 75.806$, $T^2 = 0.021$), so we also conducted moderator analyses for age and gender as continuous variables and ROB as a categorical variable. Neither age ($b = 0.004$, $p = .636$) nor gender ($b = 0.123$, $p = .641$) emerged as significant moderators. The combined between-subjects effect size was not significant for the low-ROB group ($k = 11$, $n = 339$, $g = -0.059$, $SE = 0.054$, $p = .275$) or the moderate-ROB group ($k = 4$, $n = 98$, $g = 0.097$, $SE = 0.075$, $p = .194$). The difference between the two groups was not significant ($Q = 2.866$, $p = .090$). Thus, age, gender, and ROB did not affect these findings.

Our findings indicate some evidence of publication bias in the within-subjects analysis for depressed individuals. The Duval and Tweedie's trim-and-fill analysis indicated that there were two studies missing that had effect sizes below the mean (for the funnel plot, see Fig. S8 in the Supplemental Material). The overall effect size remained small after removing these two studies using the trim-and-fill analysis ($g = -0.05$). The results from the Egger's test indicated that there was no evidence of publication bias ($SE = 1.65$, $p = .59$), and the fail-safe *N* was not significant ($z = -0.95$, $p = .34$).

Meta-analysis of between-subjects biases for self-referential information

For all between-subjects analysis, a positive Hedges's *g* indicates that depressed individuals demonstrated a greater bias than nondepressed individuals (e.g., depressed individuals endorsed more negative words than nondepressed individuals). A negative Hedges's *g* for nondepressed individuals demonstrated a greater bias than depressed individuals (e.g., nondepressed individuals endorsed more positive words than depressed individuals). For the results of between-subjects self-referential meta-analyses, see Tables 2 and 3.

Endorsement.

Positive cognitive biases. Fifteen samples were included in our meta-analysis of between-subjects endorsement for self-referential positive words. The combined effect size was large, negative, and significant ($k = 15$, $n = 702$, $g = -1.849$, $SE = 0.190$, $p < .001$; see Fig. 3). Thus, our third hypothesis was supported with a large-sized effect: Depressed individuals endorsed fewer positive words as self-referential than nondepressed individuals.

We conducted moderator analyses for clinical status and depressive-symptom severity as categorical variables (see Table 2).[15] The combined between-subjects effect size was significant for the clinical group ($k = 13$, $n = 648$, $g = -1.919$, $SE = 0.199$, $p < .001$) and the nonclinical group ($k = 2$, $n = 54$, $g = -1.309$, $SE = 0.472$, $p = .006$). The difference between the two groups was not significant ($Q = 1.420$, $p = .233$). Thus, although the overall difference was not significant, a greater bias difference emerges between depressed and nondepressed individuals for endorsement of self-referential positive words when examining individuals who meet criteria for MDD in the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-5*; American Psychiatric Association, 2013). The combined between-subjects effect size was significant for the mild

Table 2. Between-Subjects Self-Referential Endorsement Meta-Analytic Results

	k	*n*	*g*	*SE*	I^2	T^2	*Q*	*b*	*p*
					Positive				
All studies	15	702	−1.849	0.190	75.430				< .001
Clinical status	15	702					1.420		.233
Clinical	13	648	−1.919	0.199					< .001
Nonclinical	2	54	−1.309	0.472					.006
Severity	15	702					0.645		.724
Mild	2	70	−1.472	0.563					.009
Moderate	9	375	−1.850	0.240					< .001
Severe	4	257	−2.022	0.391					< .001
Age (continuous)	14	686		0.031				0.011	.715
Gender (continuous)	13	615		1.287				−0.261	.839
					Negative				
All studies	15	702	2.178	0.248	83.911	0.752			< .001
Clinical status	15	702					1.086		.297
Clinical	13	648	2.284	0.250					< .001
Nonclinical	2	54	1.447	0.584					.058
Severity	15	702					6.489		.039
Mild	2	70	1.522	0.782					.052
Moderate	9	375	1.914	0.193					< .001
Severe	4	257	3.093	0.442					< .001
Age (continuous)	14	686		0.039				−0.058	.137
Gender (continuous)	13	615		1.686				0.709	.674

Note: Positive Hedges's *g* indicates greater bias for depressed individuals; negative Hedges's *g* indicates greater bias for nondepressed individuals.

group ($k = 2$, $n = 70$, $g = -1.472$, $SE = 0.563$, $p = .009$), moderate group ($k = 9$, $n = 375$, $g = -1.850$, $SE = 0.240$, $p < .001$), and severe group ($k = 4$, $n = 257$, $g = -2.022$, $SE = 0.391$, $p < .001$). The difference between the three groups was not significant (Q = 0.645, $p = .724$). Thus, although the overall difference was not significant, a progressively greater bias difference emerges between depressed and nondepressed individuals for endorsement of self-referential positive words as depressive-symptom severity increases.

Our results suggested significant heterogeneity ($I^2 = 75.430$, $T^2 = 0.395$), so we also conducted moderator analyses for age and gender as continuous variables. Neither age ($b = 0.011$, $p = .715$) nor gender ($b = -0.261$, $p = .839$) emerged as significant moderators. Because there was only one sample in the moderate-ROB group, we did not conduct ROB moderator analyses.

Our findings indicate no evidence of publication bias. The Duval and Tweedie's trim-and-fill analysis indicated that there were no studies missing that had effect sizes below or above the mean (for the funnel plot, see Fig. S9 in the Supplemental Material). The results from the Egger's test also indicated that there was no evidence of publication bias ($SE = 2.40$, $p = .57$).

Negative cognitive biases. Fifteen samples were included in our meta-analysis of between-subjects endorsement for self-referential negative words. The combined effect size was large, positive, and significant ($k = 15$, $n = 702$, $g = 2.178$, $SE = 0.248$, $p < .001$; see Fig. 4). Thus, our fifth hypothesis was supported with a large-sized effect: Depressed individuals endorsed more negative words as self-referential than nondepressed individuals.

We conducted moderator analyses for clinical status and depressive-symptom severity as categorical variables (see Table 2). The combined between-subjects effect size was significant for the clinical group ($k = 13$, $n = 648$, $g = 2.284$, $SE = 0.250$, $p < .001$) but not the nonclinical group ($k = 2$, $n = 54$, $g = 1.447$, $SE = 0.584$, $p = .058$). The difference between the two groups was not significant (Q = 1.086, $p = .297$). Thus, although the overall difference was not significant, only individuals in the clinical group endorsed more self-referential negative words than nondepressed individuals. The combined between-subjects effect size was significant for the moderate group ($k = 9$, $n = 375$, $g = 1.914$, $SE = 0.193$, $p < .001$) and severe group ($k = 4$, $n = 257$, $g = 3.093$, $SE = 0.442$, $p < .001$) but not the mild group ($k = 2$, $n = 70$, $g = 1.522$, $SE = 0.782$, $p = .052$). The difference between the three groups was significant (Q = 6.489, $p = .039$). Thus, only individuals in the moderate and severe groups (and not the mild group) endorsed more self-referential negative words than nondepressed

Table 3. Between-Subjects Self-Referential Recall Meta-Analytic Results

	k	*n*	*g*	*SE*	I^2	T^2	*Q*	*b*	*p*
					Positive				
All studies	20	938	−1.037	0.184	84.618	0.555			< .001
Clinical status	20	938					9.151		.002
Clinical	14	698	−1.246	0.231					< .001
Nonclinical	6	240	−0.452	0.125					< .001
Severity	20	938					28.609		< .001
Minimal	2	165	−0.389	0.160					.015
Mild	4	119	−0.379	0.165					.022
Moderate	10	397	−1.195	0.287					< .001
Severe	4	257	−1.720	0.240					< .001
Age (continuous)	18	683		0.025				0.014	.590
Gender (continuous)	18	851		1.121				−1.321	.195
Recall delay (continuous)	20	938		0.070				−0.025	.718
Risk of bias	20	938					2.050		.152
Low	16	831	−1.090	0.213					< .001
Moderate	4	107	−0.661	0.211					.002
					Negative (without Outlier)				
All studies	17	838	0.871	0.185	82.787	0.461			< .001
Clinical status	17	838					9.993		.002
Clinical	12	611	1.113	0.216					< .001
Nonclinical	5	227	0.309	0.134					.021
Severity	17	838					7.564		.056
Minimal	2	165	0.339	0.159					.034
Mild	3	106	0.417	0.193					.030
Moderate	9	359	1.028	0.261					< .001
Severe	3	208	1.262	0.499					.012
Age (continuous)	15	673		0.025				−0.018	.455
Gender (continuous)	17	838		0.477				0.533	.616
Recall delay (continuous)	17	838		0.029				−0.024	.401
Risk of bias	17	838					8.028		.005
Low	13	731	1.056	0.209					< .001
Moderate	4	107	0.249	0.193					.196

Note: Positive Hedges's *g* indicates greater bias for depressed individuals; negative Hedges's *g* indicates greater bias for nondepressed individuals.

individuals; there was a larger difference in the severe group.

Our results suggested significant heterogeneity (I^2 = 83.911, T^2 = 0.752), so we also conducted moderator analyses for age and gender as continuous variables. Neither age (b = –0.058, p = .137) nor gender (b = 0.709, p = .674) emerged as significant moderators. Because there was only one sample in the moderate-ROB group, we did not conduct ROB moderator analyses.

Our findings indicate no evidence of publication bias. The Duval and Tweedie's trim-and-fill analysis indicated that there were no studies missing that had effect sizes below or above the mean (for the funnel plot, see Fig. S10 in the Supplemental Material). The results from the Egger's test also indicated that there was no evidence of publication bias (SE = 3.02, p = .86).

Recall.

Positive cognitive biases. Twenty samples were included in our meta-analysis of between-subjects recall for self-referential positive words. The combined effect size was large, negative, and significant (k = 20, n = 938, g = −1.037, SE = 0.184, p < .001; see Fig. 4). Thus, our fourth hypothesis was supported with a large-sized effect: Depressed individuals across all samples recalled fewer self-referential positive words than nondepressed individuals.

We conducted moderator analyses for clinical status and depressive-symptom severity as categorical variables (see Table 3). The combined between-subjects effect size was significant for the clinical group (k = 14, n = 698, g = −1.246, SE = 0.231, p < .001) and the nonclinical group (k = 6, n = 240, g = −0.452, SE = 0.125,

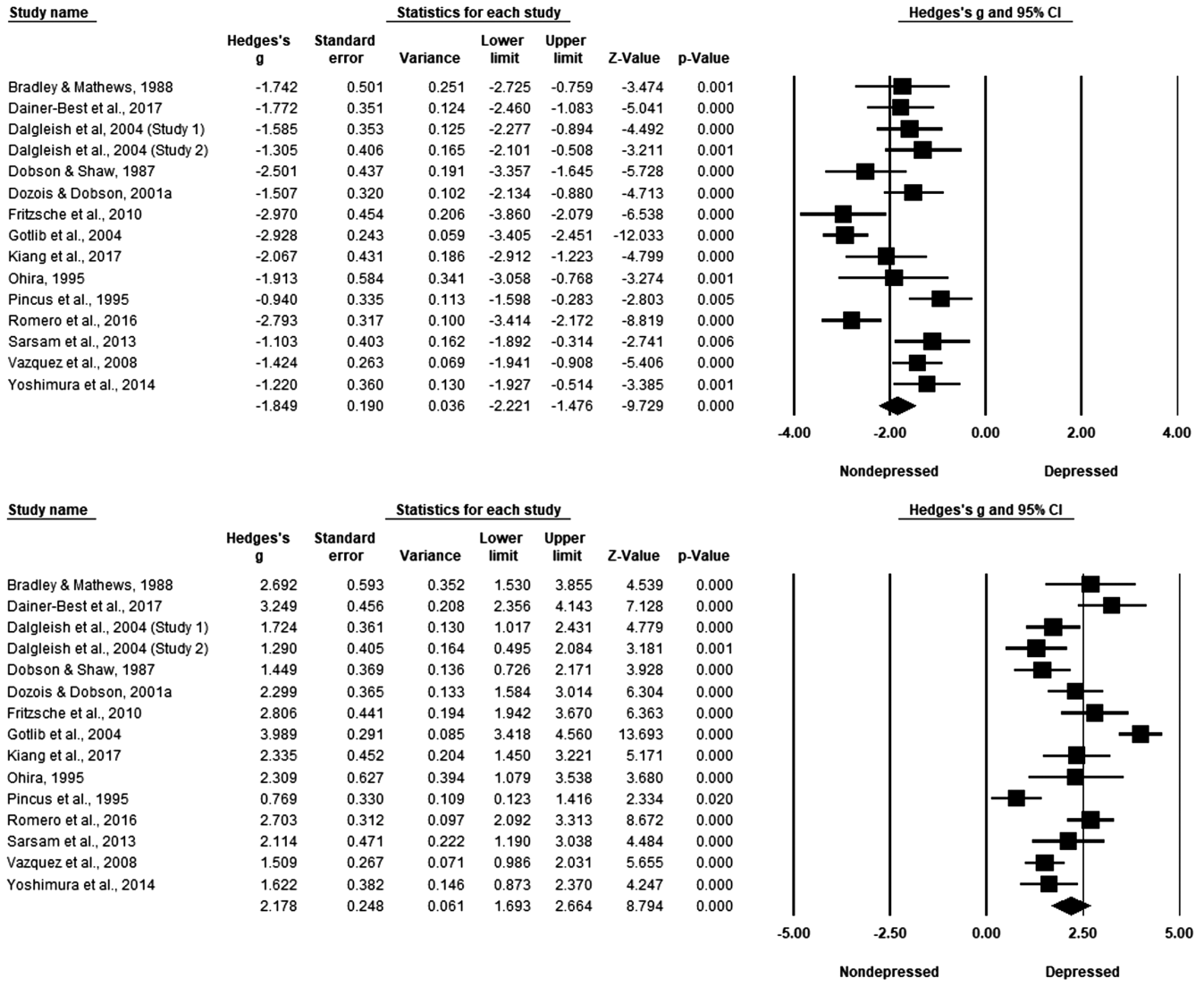

Fig. 3. Endorsement of self-referential words (between-subjects). Bottom line of each analysis indicates the statistics for the combined effect size. (Top) Endorsement of self-referential positive words. (Bottom) Endorsement of self-referential negative words.

$p < .001$). The difference between the two groups was significant (Q = 9.151, $p = .002$). Thus, a greater bias difference emerges between depressed and nondepressed individuals for recall of self-referential positive words when examining individuals who meet *DSM-5* (American Psychiatric Association, 2013) criteria for MDD, although both groups differed from control groups. We also examined differences across graded groups. The combined between-subjects effect size was significant for the minimal group ($k = 2$, $n = 165$, $g = -0.389$, $SE = 0.160$, $p = .015$), mild group ($k = 4$, $n = 119$, $g = -0.379$, $SE = 0.165$, $p = .022$), moderate group ($k = 10$, $n = 397$, $g = -1.195$, $SE = 0.287$, $p < .001$), and severe group ($k = 4$, $n = 257$, $g = -1.720$, $SE = 0.240$, $p < .001$). The difference between the four groups was significant (Q = 28.609, $p < .001$). Thus, a progressively greater bias difference emerges between depressed and nondepressed individuals for recall of self-referential positive words as depressive-symptom severity increases.

Our results suggested significant heterogeneity ($I^2 = 84.618$, $T^2 = 0.555$), so we also conducted moderator analyses for age, gender, and recall delay as continuous variables and ROB as a categorical variable. Neither age ($b = 0.014$, $p = .590$), gender ($b = -1.321$, $p = .195$), nor recall delay ($b = -0.025$, $p = .718$) emerged as significant moderators. Thus, age, gender, and recall delay did not affect these findings. The combined between-subjects effect size was significant for the low-ROB group ($k = 16$, $n = 831$, $g = -1.090$, $SE = 0.213$, $p < .001$) and the

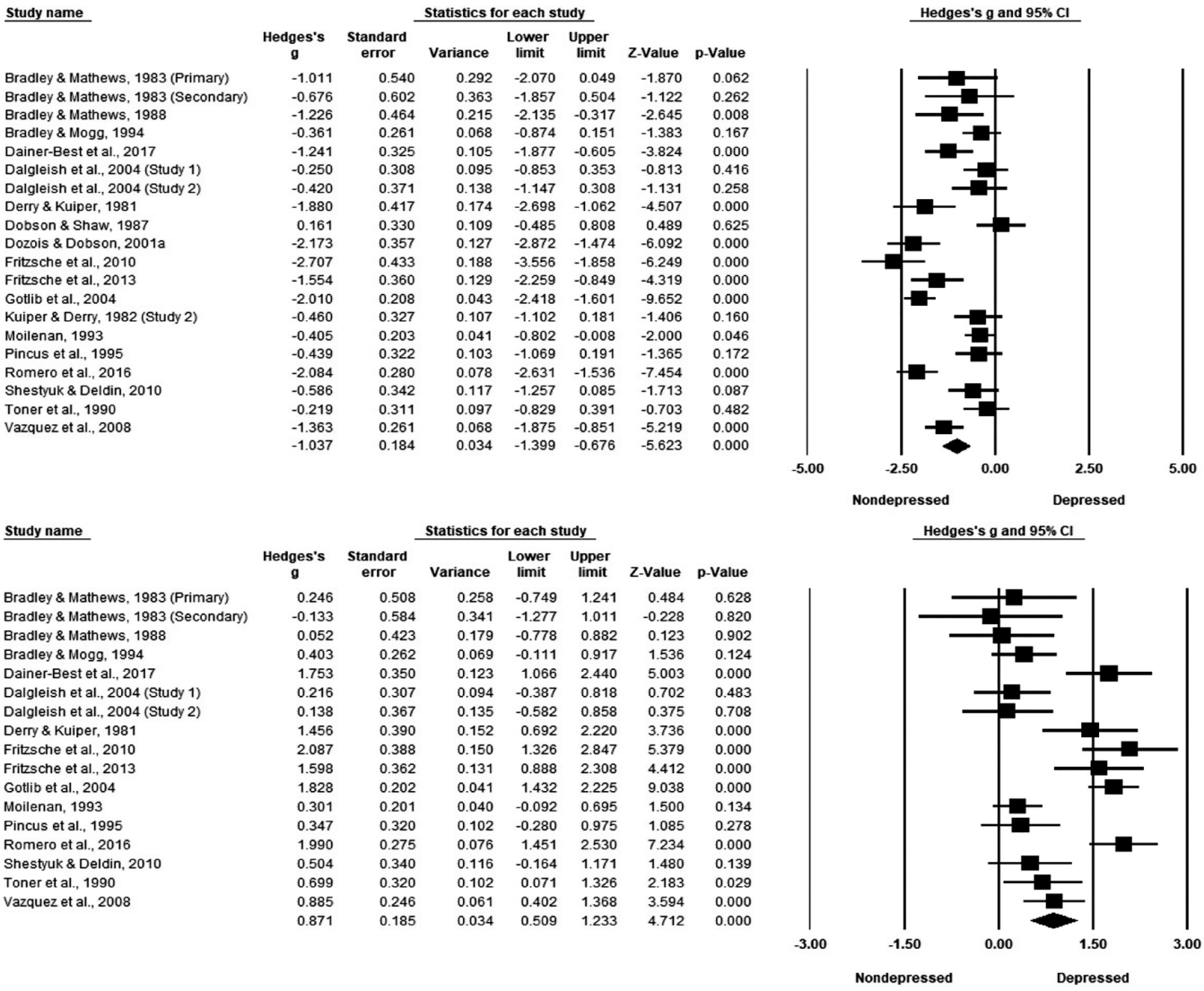

Fig. 4. Recall of self-referential words (between-subjects). Bottom line of each analysis indicates the statistics for the combined effect-size. (Top) Recall of self-referential positive words. (Bottom) Recall of self-referential negative words. Bradley and Mathews (1983) included two clinical groups (primary and secondary); thus, we split the control-group sample size in half to compare both clinical groups against the control group, as done in previous meta-analyses (Bar-Haim et al., 2007; Winer & Salem, 2016).

moderate-ROB group (k = 4, n = 107, g = −0.661, SE = 0.211, p = .002). The difference between the two groups was not significant (Q = 2.050, p = .152). Thus, samples in the low-ROB group demonstrated a greater bias for recall of positive words compared with samples in the moderate-ROB group.

Our findings indicate no evidence of publication bias. The Duval and Tweedie's trim-and-fill analysis indicated that there were no studies missing that had effect sizes below or above the mean (for the funnel plot, see Fig. S11 in the Supplemental Material). The results from the Egger's test also indicated that there was no evidence of publication bias (SE = 2.25, p = .87).

Negative cognitive biases. One sample was not included because the control group had zeroes for their means and standard deviations and effect sizes could not be computed for this sample. Thus, 17 samples were included in our meta-analysis of between-subjects recall of self-referential negative words.[16] The combined effect size was large, positive, and significant (k = 17, n = 838, g = 0.871, SE = 0.185, p < .001; see Fig. 4). Thus, our sixth hypothesis was supported with a large-sized effect: Depressed individuals across all samples recalled more self-referential negative words than nondepressed individuals.

We conducted moderator analyses for clinical status and depressive-symptom severity as categorical variables (see Table 3). The combined between-subjects

effect size was significant for the clinical group (k = 12, n = 611, g = 1.113, SE = 0.216, p < .001) and the nonclinical group (k = 5, n = 227, g = 0.309, SE = 0.134, p = .021). The difference between the two groups was significant (Q = 9.993, p = .002). Thus, a greater bias difference emerges between depressed and nondepressed individuals for recall of self-referential negative words when examining individuals who meet *DSM-5* (American Psychiatric Association, 2013) criteria for MDD. The combined between-subjects effect size was again significant for the minimal group (k = 2, n = 165, g = 0.339, SE = 0.159, p = .034), mild group (k = 3, n = 106, g = 0.417, SE = 0.193, p = .030), moderate group (k = 9, n = 359, g = 1.028, SE = 0.261, p < .001), and severe group (k = 3, n = 208, g = 1.262, SE = 0.499, p = .012). The difference between the four groups was not significant (Q = 7.564, p = .056). Thus, although the overall difference was not significant, a progressively greater bias difference emerges between depressed and nondepressed individuals for recall of self-referential negative words as depressive-symptom severity increases.

Our results suggested significant heterogeneity (I^2 = 82.787, T^2 = 0.461), so we also conducted moderator analyses for age, gender, and recall delay as continuous variables and ROB as a categorical variable. Neither age (b = –0.018, p = .455), gender (b = 0.533, p = .616), nor recall delay (b = 0.024, p = .401) emerged as significant moderators. Thus, age, gender, and recall delay did not affect our findings. The combined between-subjects effect size was significant for the low-ROB group (k = 13, n = 731, g = 1.056, SE = 0.209, p < .001) but not the moderate-ROB group (k = 4, n = 107, g = 0.249, SE = 0.193, p = .196). The difference between the two groups was significant (Q = 8.028, p = .005). Thus, samples in the low-ROB group demonstrated a greater bias for recall of negative words compared with samples in the moderate-ROB group.

Our findings indicate no evidence of publication bias. The Duval and Tweedie's trim-and-fill analysis indicated that there were no studies missing that had effect sizes below or above the mean (for the funnel plot, see Fig. S12 in the Supplemental Material). The results from the Egger's test also indicated that there was no evidence of publication bias (SE = 2.20, p = .53).

RT.

Positive cognitive biases. Eleven samples were included in our meta-analysis of between-subjects RTs for self-referential positive words. The combined effect size was not significant (k = 11, n = 449, g = 0.315, SE = 0.179, p = .078; see Fig. S13 in the Supplemental Material). These results suggest that there were no significant differences between depressed and nondepressed individuals for their RTs for self-referential positive words.

We conducted moderator analyses for clinical status and depressive-symptom severity as categorical variables (see Table S6 in the Supplemental Material). The combined between-subjects effect size was not significant for either the clinical group (k = 8, n = 411, g = 0.298, SE = 0.215, p = .164) or the nonclinical group (k = 3, n = 68, g = 0.395, SE = 0.310, p = .202). The difference between the two groups was not significant (Q = 0.066, p = .797). Thus, clinical group status did not affect these findings. The combined between-subjects effect size was significant for the severe group (k = 3, n = 236, g = 0.450, SE = 0.133, p = .001) but not the moderate group (k = 8, n = 236, g = 0.256, SE = 0.281, p = .363). The difference between the two groups was not significant (Q = 0.389, p = .533). Thus, although the overall difference was not significant, only individuals in the severe group took longer to respond to self-referential positive words than nondepressed individuals. Because our results did not suggest significant heterogeneity (I^2 = 66.565, T^2 = 0.216), we did not conduct additional moderator analyses for age, gender, and ROB.

Our findings indicate no evidence of publication bias. The Duval and Tweedie's trim-and-fill analysis indicated that there were no studies missing that had effect sizes below or above the mean (for the funnel plot, see Fig. S14 in the Supplemental Material). The results from the Egger's test also indicated that there was no evidence of publication bias (SE = 1.60, p = .90).

Negative cognitive biases. Eleven samples were included in our meta-analysis of between-subjects RTs for self-referential negative words. The combined effect size was large, positive, and significant (k = 11, n = 449, g = 0.520, SE = 0.188, p = .006; see Fig. S13 in the Supplemental Material). These results suggest that depressed individuals take longer to respond to self-referential negative words than nondepressed individuals.

We conducted moderator analyses for clinical status and depressive-symptom severity as categorical variables (see Table S6 in the Supplemental Material). The combined between-subjects effect size was significant for the clinical group (k = 8, n = 411, g = 0.527, SE = 0.219, p = .016) but not the nonclinical group (k = 3, n = 38, g = 0.505, SE = 0.409, p = .218). The difference between the two groups was not significant (Q = 0.002, p = .962). Thus, although the overall difference was not significant, individuals in the clinical group took significantly longer to respond to self-referential negative words than nondepressed individuals, and there was no significant difference between individuals in the nonclinical group and nondepressed individuals. The combined between-subjects effect size was significant for the severe group (k = 3, n = 236, g = 0.616, SE =

Table 4. Within-Subjects Other-Referential Meta-Analytic Results for Depressed Individuals

	k	*n*	*g*	*SE*	I^2	T^2	*p*
Endorsement							
Familiar	2	32	3.623	1.166	96.474	2.622	.002
Unfamiliar	3	44	2.256	0.218	66.034	0.094	< .001
Recall							
Familiar	4	48	0.506	0.152	79.315	0.069	.001
Unfamiliar	5	56	0.100	0.178	89.111	0.140	.575

Note: Positive Hedges's *g* indicates bias for positive words; negative Hedges's *g* indicates bias for negative words.

0.134, $p < .001$) but not the moderate group ($k = 8$, $n = 213$, $g = 0.507$, $SE = 0.303$, $p = .094$). The difference between the two groups was not significant (Q = 0.109, $p = .741$). Thus, although the overall difference was not significant, only individuals in the severe group took longer to respond to self-referential negative words than nondepressed individuals. Because our results did not suggest significant heterogeneity ($I^2 = 69.093$, $T^2 = 0.248$), we did not conduct additional moderator analyses for age, gender, and ROB.

Our findings indicate no evidence of publication bias. The Duval and Tweedie's trim-and-fill analysis indicated that there were no studies missing that had effect sizes below or above the mean (for the funnel plot, see Fig. S15 in the Supplemental Material). The results from the Egger's test also indicated that there was no evidence of publication bias ($SE = 1.64$, $p = .86$).

Meta-analysis of within-subjects biases for other-referential information

Because all within-subjects other-referential meta-analyses contained five or fewer samples, we did not conduct moderation or publication-bias analyses. Because of the small number of samples (and participants) included in each analysis, these results should be interpreted with caution. For the results of within-subjects other-referential meta-analyses for depressed individuals, see Table 4. For the results of within-subjects other-referential meta-analyses for nondepressed individuals, see Table S7 in the Supplemental Material.

Endorsement.

Familiar other-referential. Two samples were included in our meta-analysis of within-subjects familiar-other endorsement for depressed individuals. The combined effect size was large, positive, and significant ($k = 2$, $n = 32$, $g = 3.623$, $SE = 1.116$, $I^2 = 96.474$, $T^2 = 2.622$, $p = .002$; see Fig. S16 in the Supplemental Material). Depressed individuals endorsed more positive words than negative words to describe a familiar other-referential person.

Two samples were included in our meta-analysis of within-subjects familiar-other endorsement for nondepressed individuals. The combined effect size was not significant ($k = 2$, $n = 33$, $g = 2.924$, $SE = 1.559$, $I^2 = 98.535$, $T^2 = 4.787$, $p = .061$; see Fig. S17 in the Supplemental Material). Although nonsignificant, nondepressed individuals did endorse more positive words than negative words to describe a familiar other-referential person.

Unfamiliar other-referential. Three samples were included in our meta-analysis of within-subjects unfamiliar-other endorsement for depressed individuals. The combined effect size was large, positive, and significant ($k = 3$, $n = 44$, $g = 2.256$, $SE = 0.218$, $I^2 = 66.034$, $T^2 = 0.094$, $p < .001$; see Fig. S16 in the Supplemental Material). Depressed individuals endorsed more positive words than negative words to describe an unfamiliar other-referential person.

Three samples were included in our meta-analysis of within-subjects unfamiliar-other endorsement for nondepressed individuals. The combined effect size was large, positive, and significant ($k = 3$, $n = 46$, $g = 1.573$, $SE = 0.291$, $I^2 = 88.768$, $T^2 = 0.222$, $p < .001$; see Fig. S17 in the Supplemental Material). Nondepressed individuals endorsed more positive words than negative words to describe an unfamiliar other-referential person.

Recall.

Familiar other-referential. Four samples were included in our meta-analysis of within-subjects familiar-other recall for depressed individuals. The combined effect size was medium, positive, and significant ($k = 4$, $n = 48$, $g = 0.506$, $SE = 0.152$, $I^2 = 79.315$, $T^2 = 0.069$, $p = .001$; see Fig. S18 in the Supplemental Material). Depressed individuals recalled more positive words than negative words when describing a familiar other-referential person.

Three samples were included in our meta-analysis of within-subjects familiar-other recall for nondepressed individuals. The combined effect size was small, positive, and significant ($k = 3$, $n = 48$, $g = 0.494$, $SE = 0.187$,

I^2 = 87.263, T^2 = 0.091, p = .008; see Fig. S19 in the Supplemental Material). Nondepressed individuals recalled more positive words than negative words when describing a familiar other-referential person.

Unfamiliar other-referential. Five samples were included in our meta-analysis of within-subjects unfamiliar-other recall for depressed individuals. The combined effect size was not significant (k = 5, n = 56, g = 0.100, SE = 0.178, I^2 = 89.111, T^2 = 0.140, p = .575; see Fig. S18 in the Supplemental Material). Depressed individuals did not differ in their recall for positive and negative words when describing an unfamiliar other-referential person.

Four samples were included in our meta-analysis of within-subjects unfamiliar-other recall for nondepressed individuals. The combined effect size was small, positive, and significant (k = 4, n = 58, g = 0.342, SE = 0.126, I^2 = 78.381, T^2 = 0.049, p = .007; see Fig. S19 in the Supplemental Material). Nondepressed individuals recalled more positive words than negative words when describing an unfamiliar other-referential person.

RT.

Familiar other-referential. Four samples were included in our meta-analysis of within-subjects familiar-other RTs for depressed individuals. The combined effect size was not significant (k = 4, n = 41, g = 0.001, SE = 0.079, I^2 = 35.885, T^2 = 0.009, p = .991; see Table S8 and Fig. S20 in the Supplemental Material). These results suggest that there were no significant differences between the RTs of positive and negative words when describing a familiar other-referential person.

Three samples were included in our meta-analysis of within-subjects familiar-other RTs for nondepressed individuals. The combined effect size was not significant (k = 3, n = 42, g = 0.051, SE = 0.145, I^2 = 79.275, T^2 = 0.050, p = .724; see Fig. S21 in the Supplemental Material). These results suggest that there were no significant differences between the RTs of positive and negative words when describing a familiar other-referential person.

Unfamiliar other-referential. Two samples were included in our meta-analysis of within-subjects unfamiliar-other RTs for depressed individuals. The combined effect size was not significant (k = 2, n = 11, g = 0.114, SE = 0.137, I^2 = 43.727, T^2 = 0.016, p = .406; see Table S8 and Fig. S20 in the Supplemental Material). These results suggest that there were no significant differences between the RTs of positive and negative words when describing an unfamiliar other-referential person.

There was only one sample that examined positive and negative words of unfamiliar-other RTs for nondepressed individuals. Thus, we did not conduct a meta-analysis for this type of analysis.

Meta-analysis of between-subjects biases for other-referential information

Because all between-subjects other-referential meta-analyses contained five or fewer samples, we did not conduct moderation analyses. Because of the small number of samples included in each analysis, these results should be interpreted with caution. For the results of between-subjects other-referential meta-analyses, see Table 5.

Endorsement.

Positive cognitive biases. Two samples were included in our meta-analysis of between-subjects endorsement for familiar-other positive words. The combined effect size was not significant (k = 2, n = 65, g = 0.226, SE = 0.244, I^2 = 0.000, T^2 = 0.000, p = .354; see Fig. S22 in the Supplemental Material). Depressed and nondepressed individuals did not differ on the endorsement of positive words to describe a familiar other-referential person.

Three samples were included in our meta-analysis of between-subjects endorsement for familiar-other positive words. The combined effect size was not significant (k = 3, n = 90, g = 0.310, SE = 0.207, I^2 = 0.000, T^2 = 0.000, p = .135; see Fig. S22 in the Supplemental Material). Depressed and nondepressed individuals did not differ on the endorsement of positive words to describe an unfamiliar other-referential person.

Negative cognitive biases. Two samples were included in our meta-analysis of between-subjects endorsement for familiar-other negative words. The combined effect size was not significant (k = 2, n = 65, g = 0.113, SE = 0.259, I^2 = 11.634, T^2 = 0.016, p = .664; see Fig. S23 in the Supplemental Material). Depressed and nondepressed individuals did not differ on the endorsement of negative words to describe a familiar, other-referential person.

Three samples were included in our meta-analysis of between-subjects endorsement for unfamiliar-other negative words. The combined effect size was not significant (k = 3, n = 90, g = 0.199, SE = 0.207, I^2 = 0.000, T^2 = 0.000, p = .335; see Fig. S23 in the Supplemental Material). Depressed and nondepressed individuals did not differ on the endorsement of negative words to describe an unfamiliar other-referential person.

Recall.

Positive cognitive biases. Four samples were included in our meta-analysis of between-subjects recall for familiar-other positive words. The combined effect size was not significant (k = 4, n = 96, g = −0.055, SE = 0.213, I^2 = 9.905,

Table 5. Between-Subjects Other-Referential Meta-Analytic Results

	k	*n*	*g*	*SE*	I^2	T^2	*p*
			Positive				
Endorsement							
Familiar	2	65	0.226	0.244	0.000	0.000	.354
Unfamiliar	3	90	0.310	0.207	0.000	0.000	.135
Recall							
Familiar	4	96	–0.055	0.213	9.905	0.019	.795
Unfamiliar	5	114	–0.658	0.187	0.000	0.000	< .001
RT							
Familiar	4	83	0.525	0.335	52.472	0.229	.117
Unfamiliar	2	22	0.597	0.406	0.000	0.000	.141
			Negative				
Endorsement							
Familiar	2	65	0.113	0.259	11.634	0.016	.664
Unfamiliar	3	90	0.199	0.207	0.000	0.000	.335
Recall							
Familiar	4	96	–0.138	0.192	0.000	0.000	.471
Unfamiliar	5	114	–0.536	0.180	0.000	0.000	.003
RT							
Familiar	4	83	0.530	0.340	53.972	0.243	.119
Unfamiliar	2	22	0.290	0.398	0.000	0.000	.467

Note: Positive Hedges's *g* indicates bias for depressed individuals; negative Hedges's *g* indicates bias for nondepressed individuals. RT = reaction time.

T^2 = 0.019, p = .795; see Fig. S24 in the Supplemental Material). Depressed and nondepressed individuals did not differ on the recall of positive words when describing a familiar other-referential person.

Five samples were included in our meta-analysis of between-subjects recall for unfamiliar-other positive words. The combined effect size was large, negative, and significant (k = 5, n = 114, g = –0.658, SE = 0.187, I^2 = 0.000, T^2 = 0.000, p < .001; see Fig. S24 in the Supplemental Material). Nondepressed individuals recalled more positive words when describing an unfamiliar other-referential person than depressed individuals.

Negative cognitive biases. Four samples were included in our meta-analysis of between-subjects recall for unfamiliar-other negative words. The combined effect size was not significant (k = 4, n = 96, g = –0.138, SE = 0.192, I^2 = 0.000, T^2 = 0.000, p = .471; see Fig. S25 in the Supplemental Material). Depressed and nondepressed individuals did not differ on the recall of negative words when describing a familiar, other-referential person.

Five samples were included in our meta-analysis of between-subjects recall for unfamiliar-other negative words. The combined effect size was medium, negative, and significant (k = 5, n = 114, g = –0.536, SE = 0.180, I^2 = 0.000, T^2 = 0.000, p = .003; see Fig. S25 in the Supplemental Material). Nondepressed individuals recalled more negative words when describing an unfamiliar other-referential person than depressed individuals.

RT.

Positive cognitive biases. Four samples were included in our meta-analysis of between-subjects RTs for familiar-other positive words. The combined effect size was not significant (k = 4, n = 83, g = 0.525, SE = 0.335, I^2 = 52.472, T^2 = 0.229, p = .117; see Fig. S26 in the Supplemental Material). Depressed and nondepressed individuals did not differ on the RTs of positive words when describing a familiar other-referential person.

Two samples were included in our meta-analysis of between-subjects RTs for unfamiliar-other positive words. The combined effect size was not significant (k = 2, n = 22, g = 0.597, SE = 0.406, I^2 = 0.000, T^2 = 0.000, p = .141; see Fig. S26 in the Supplemental Material). Depressed and nondepressed individuals did not differ on the RTs of positive words when describing an unfamiliar other-referential person.

Negative cognitive biases. Four samples were included in our meta-analysis of between-subjects RTs for familiar-other negative words. The combined effect size was not significant (k = 4, n = 83, g = 0.530, SE = 0.340, I^2 = 53.972, T^2 = 0.243, p = .119; see Fig. S27 in the Supplemental

Material). Depressed and nondepressed individuals did not differ on the RTs of negative words when describing a familiar other-referential person.

Two samples were included in our meta-analysis of between-subjects RTs for unfamiliar-other negative words. The combined effect size was not significant ($k = 2$, $n = 22$, $g = 0.290$, $SE = 0.398$, $I^2 = 0.000$, $T^2 = 0.000$, $p = .467$; see Fig. S27 in the Supplemental Material). Depressed and nondepressed individuals did not differ on the RTs of negative words when describing a familiar other-referential person.

Meta-analysis of within-subjects biases for self- versus other-referential information

To investigate how depressed individuals differed in their processing of emotional information when describing themselves and familiar-other individuals, we conducted additional within-subjects meta-analyses. A positive Hedges's *g* represents a bias for self-referential information, and a negative Hedges's *g* represents a bias for familiar other-referential information.[17] Because of the small number of samples included in each analysis, these results should be interpreted with caution.

Positive cognitive biases.

Endorsement. Two samples were included in our meta-analysis of within-subjects endorsement for positive words. The combined effect size was not significant ($k = 2$, $n = 32$, $g = -0.302$, $SE = 0.342$, $I^2 = 94.575$, $p = .376$; see Fig. S28 in the Supplemental Material). Although the effect is nonsignificant, this finding differs markedly from the null findings for within-subjects self-referential endorsement ($g = -0.019$), suggesting that depressed individuals endorse more positive words when describing familiar others than when describing themselves.

Recall. Four samples were included in our meta-analysis of within-subjects recall for positive words. The combined effect size was not significant ($k = 4$, $n = 48$, $g = -0.020$, $SE = 0.059$, $I^2 = 0.000$, $p = .742$; see Fig. S28 in the Supplemental Material). Thus, depressed individuals did not differ in their recall of self-referential and familiar other-referential positive words.

Negative cognitive biases.

Endorsement. Two samples were included in our meta-analysis of within-subjects endorsement for negative words. The combined effect size was medium, positive, and significant ($k = 2$, $n = 32$, $g = 0.775$, $SE = 0.219$, $I^2 = 83.124$, $p < .001$; see Fig. S29 in the Supplemental Material). Thus, depressed individuals endorse more negative words to describe themselves than to describe familiar others.

Recall. Four samples were included in our meta-analysis of within-subjects recall for negative words. The combined effect size was medium, positive, and significant ($k = 4$, $n = 48$, $g = 0.696$, $SE = 0.174$, $I^2 = 83.288$, $p < .001$; see Fig. S29 in the Supplemental Material). Thus, depressed individuals recalled more negative self-referential words than familiar other-referential words.

ROB

Twenty-four studies were found to have an overall low ROB, and four studies were found to have an overall moderate ROB. No study was found to have an overall serious or critical ROB. For the ROB plot and summary, see Figures S33 and S34, respectively.

Discussion

The aim of this systematic review and meta-analysis was to summarize the existing literature on self-referential processing for depressed individuals in the frameworks of Beck's cognitive theory and reward devaluation theory. Our constellation of findings provides evidence for both frameworks and suggests that depressed individuals do differ in their processing of positive and negative self-referential information and demonstrate a discriminant pattern of processing compared with nondepressed individuals (for brevity, we have summarized all of our analyses and respective effect sizes in Table 6). These findings, wrought from an extraordinarily careful and preregistered analytical protocol, inform—and in some cases, antagonistically inform—the current understanding of self-referential processing by depressed individuals. We outline our findings below regarding novelty and importance to the overarching literature base.

Recall

Our within-subjects meta-analytic findings demonstrated that depressed individuals recalled fewer self-referential positive words than negative words. In addition, depressed individuals recalled fewer self-referential positive words than did nondepressed individuals and more self-referential negative words than did nondepressed individuals. These findings are in line with a recent meta-analysis that demonstrated depressed individuals recall fewer positive words and more negative words overall (Everaert et al., 2022).

Table 6. Summary of Findings

Comparison type	Referential type	Group	Outcome variable	Pooled effect size	Clinical status	Severity
Within-subjects	Self	Depressed	Endorsement	−0.019	No	No
Within-subjects	Self	Nondepressed	Endorsement	4.376	—	—
Within-subjects	Self	Depressed	Recall	−0.156	No	No
Within-subjects	Self	Nondepressed	Recall	2.440	—	—
Within-subjects	Self	Depressed	Reaction times	−0.017	No	No
Within-subjects	Self	Nondepressed	Reaction times	0.103	—	—
Between-subjects	Self	Positive	Endorsement	−1.849	No	No
Between-subjects	Self	Negative	Endorsement	2.178	No	Yes
Between-subjects	Self	Positive	Recall	−1.037	Yes	Yes
Between-subjects	Self	Negative	Recall	0.871	Yes	No
Between-subjects	Self	Positive	Reaction times	0.315	No	No
Between-subjects	Self	Negative	Reaction times	0.520	No	No
Within-subjects	Other (familiar)	Depressed	Endorsement	3.623	—	—
Within-subjects	Other (familiar)	Nondepressed	Endorsement	2.924	—	—
Within-subjects	Other (unfamiliar)	Depressed	Endorsement	2.256	—	—
Within-subjects	Other (unfamiliar)	Nondepressed	Endorsement	1.573	—	—
Within-subjects	Other (familiar)	Depressed	Recall	0.506	—	—
Within-subjects	Other (familiar)	Nondepressed	Recall	0.494	—	—
Within-subjects	Other (unfamiliar)	Depressed	Recall	0.100	—	—
Within-subjects	Other (unfamiliar)	Nondepressed	Recall	0.342	—	—
Within-subjects	Other (familiar)	Depressed	Reaction times	0.001	—	—
Within-subjects	Other (familiar)	Nondepressed	Reaction times	0.724	—	—
Within-subjects	Other (unfamiliar)	Depressed	Reaction times	0.051	—	—
Within-subjects	Other (unfamiliar)	Nondepressed	Reaction times	—	—	—
Between-subjects	Other (familiar)	Positive	Endorsement	0.244	—	—
Between-subjects	Other (unfamiliar)	Positive	Endorsement	0.207	—	—
Between-subjects	Other (familiar)	Negative	Endorsement	0.113	—	—
Between-subjects	Other (unfamiliar)	Negative	Endorsement	0.199	—	—
Between-subjects	Other (familiar)	Positive	Recall	−0.055	—	—
Between-subjects	Other (unfamiliar)	Positive	Recall	−0.658	—	—
Between-subjects	Other (familiar)	Negative	Recall	−0.138	—	—
Between-subjects	Other (unfamiliar)	Negative	Recall	−0.536	—	—
Between-subjects	Other (familiar)	Positive	Reaction times	0.525	—	—
Between-subjects	Other (unfamiliar)	Positive	Reaction times	0.597	—	—
Between-subjects	Other (familiar)	Negative	Reaction times	0.530	—	—
Between-subjects	Other (unfamiliar)	Negative	Reaction times	0.290	—	—
Within-subjects	Self vs. other	Positive	Endorsement	−0.302	—	—
Within-subjects	Self vs. other	Positive	Recall	−0.020	—	—
Within-subjects	Self vs. other	Negative	Endorsement	0.775	—	—
Within-subjects	Self vs. other	Negative	Recall	0.696	—	—

Note: Gray-, green- and red-colored effect sizes represent no bias, positive bias, or negative bias, respectively, for the within-subjects findings. Blue- and yellow-colored effect sizes represent a greater bias for depressed individuals or greater bias for nondepressed individuals, respectively, for between-subjects findings. Orange-colored effect sizes represent a greater bias for self-referential words for within-subjects findings. Yes or no indicates whether each moderator significantly moderated the respective analysis.

A discriminant pattern was found regarding other-referential recall; however, we emphasize that the other-referential results should be interpreted with caution because of the small number of samples included. We present our interpretations below with the caveat that our findings are limited because of the lack of other-referential findings in the literature. Despite the small samples in each analysis, we hope that the following findings spur future researchers to include an other-referential condition in their future studies to better investigate differences between self-referential and other-referential processing.

When asked to recall information about a familiar-other person (e.g., their best friend), depressed individuals recalled more positive words than negative words. In addition, they did not significantly differ in their recall of positive words from nondepressed individuals and in their recall of negative words from nondepressed individuals. Thus, whereas depressed individuals demonstrated normative recall for individuals with whom they are familiar, they devalued positivity and facilitated negativity for self-related adjectives compared with nondepressed individuals. Taken together, these findings suggest that how depressed individuals recall emotional information about other individuals with whom they are familiar differs from how they recall information about themselves. Within-subjects differences when self- and other-familiar recall were compared were strongest for negative and not positive words, unlike what has been found in the attentional-bias self-referential literature (Ji et al., 2017). However, because of a lack of studies in the literature that examined other-referential processing, our other-referential familiar recall analyses included a small number of samples (i.e., four samples taken from three studies). Thus, future studies that examine both self-referential and other-referential recall within subjects will provide further insight into how depressed individuals remember emotional information describing themselves and others.

When asked to recall information about an unfamiliar-other person (e.g., the mail person), depressed individuals did not differ in their recall of positive words and negative words. In addition, depressed individuals recalled fewer positive and negative words than nondepressed individuals. This differs from the pattern regarding recall of a familiar-other person such that there may be a discriminant processing between the familiar and unfamiliar conditions, but the same caveats regarding the number of samples with other-referential conditions apply. Specifically, depressed and nondepressed individuals may not differ in their recall for a familiar-other person given that this person (e.g., their best friend) is highly salient to both groups. However, the difference regarding unfamiliar individuals may indicate the presence of memory-bias difficulties in general for depressed individuals when they do not have a salient individual to recall words about. As noted above, it is plausible that political figures (e.g., the president) could be considered as an unfamiliar-other person rather than a familiar-other person given that an individual likely does not personally know the political figures. However, existing studies using the SRET have categorized political figures as familiar others (Kelley et al., 2002; Sarsam et al., 2013; Shestyuk & Deldin, 2010), thus we followed the same categorization in the current study. Although there may be more elaborate processing done when thinking about someone with whom they intimately know (e.g., their best friend) compared with someone with whom they do not intimately know (e.g., the president), prior meta-analytic findings have indicated that there are no significant differences in recall between intimate and nonintimate categories (Symons & Johnson, 1997)

Our findings diverge from previous meta-analyses that suggested that depressed individuals do not differ from nondepressed individuals in their emotional memory biases (Bogie et al., 2019). Beyond the findings outlined above, our findings also suggest a reduced memory bias for positive words and enhanced memory bias for negative words when examining only depressed individuals who were diagnosed with MDD from a standardized assessment (e.g., the SCID), as done by Bogie et al. (2019). Our findings might diverge from theirs because in the current study, we examined self-referential stimuli specifically, whereas Bogie et al. did not account for whether the memory biases were from self- or other-referential processing. Moreover, they included studies that used different stimuli, including words and images. Thus, the methods from the current meta-analysis focused on a more specific prospective signal than those of Bogie et al.

Endorsement

Our within-subjects meta-analytic findings demonstrate that depressed individuals did not generally differ in their endorsement of self-referential positive and negative words. Although this finding was not in line with our hypothesis, it is nonetheless not surprising because of the nature of the SRET. Specifically, participants are given the same number of positive and negative words to make decisions about, so it is possible that depressed individuals could hold both devaluative and depressed schemas (i.e., endorse fewer positive words and more negative words at the same time) given that these endorsement metrics are independently calculated from each other. Whereas a clear pattern emerged with the recall findings discussed above, it is possible that these findings represent a more nuanced approach to devaluative and depressed schemas given the explicit nature of endorsing "yes" or "no" (because recall is less explicit). When we followed up this null finding with moderator analyses, however, depressive-symptom severity moderated this relationship such that people with greater severity of symptoms endorsed fewer positive words than negative words. Thus, individuals with severe levels of depressed symptoms are making the deliberate decision to say "no" more to positive words describing them, and it is possible that this difference,

reflecting a devaluation of positivity, emerges only as depression becomes more debilitating (i.e., as symptom severity increases). Indeed, prior research has suggested that the way in which depressed individuals organize their schemas changes, with reversal patterns in this organization emerging between moderate and severe depression (Collins et al., 2023).

In contrast, when asked to make decisions about whether positive or negative words describe a familiar (e.g., best friend) or unfamiliar (e.g., the mail person) person, depressed individuals endorsed more positive words than negative words. Thus, whereas depressed individuals did not differ on the endorsement of valanced words when describing themselves unless their symptoms were severe, they did differ when describing others. When comparing self- and other-familiar endorsement of both positive and negative words, we found that depressed individuals endorsed more positive words to describe individuals with whom they are familiar than they did to describe themselves, yielding a low to moderate effect size ($g = -0.302$), albeit an effect that was nonsignificant because of only two studies being available for inclusion. In addition, they endorsed more negative words to describe themselves than they did to describe individuals with whom they are familiar. Thus, depressed individuals describe themselves in a less positive and more negative manner compared with how they describe others.

Depressed individuals endorsed fewer positive words as self-referential than did nondepressed individuals and more negative words as self-referential than did nondepressed individuals. Moreover, moderator analyses revealed that the respective effect sizes became progressively larger as depressive-symptom severity increased, suggesting that depressed individuals' devaluation of positivity and facilitatory endorsement of negativity become more pronounced as symptom severity increased. This is consistent with prior work that demonstrated depressed individuals process positive information in a biased manner (Hsu et al., 2020; McNamara et al., 2021) and may point to a more specific mechanism of devaluation of the self, as initially hypothesized when reward devaluation theory was introduced (Winer & Salem, 2016). By comparison, depressed individuals did not differ from nondepressed individuals on the endorsement of positive words and the endorsement of negative words when describing others (whereas they did differ from each other on the recall for unfamiliar-other positive and negative words).

Whereas it has been traditionally predicted that depressed individuals view themselves in a less positive manner as an artifact of their enhanced negative biases, our results suggest that depressed individuals may devalue positive adjectives when describing themselves and not other people. Indeed, this is a unique factor captured with the self-referential encoding task: Individuals consciously select "yes" or "no" for each word to describe themselves. Thus, lower endorsements of positive words do not reflect a lack of positive bias but instead reflect greater rejection (or devaluation) of positive words (i.e., confident is simply not me).

Taken together, our constellation of endorsement findings provides strong support that depressed individuals devalue self-referential positivity. They are more likely to select "no" when asked if a positive word describes them than when asked if a positive word describes someone with whom they are familiar. They are also more likely to select "no" when asked if a positive word describes them compared with nondepressed individuals. Thus, depressed individuals process self-referential positivity in a unique, devaluative manner such that they explicitly make decisions that positive words do not describe them, demonstrating a pattern discriminant from nondepressed individuals.

RTs

Investigation of RTs revealed that depressed individuals did not demonstrate within-subjects differences for their RTs for self-referential or other-referential (both familiar and unfamiliar) positive and negative words. Thus, the speed at which depressed individuals make decisions regarding words to describe themselves or others does not differ based on the valence in the SRET.

Investigation of the between-subjects differences for RTs to positive words demonstrated that depressed individuals did not differ from nondepressed individuals in their RTs to self-referential positive words. However, moderator analyses revealed that individuals with severe symptoms of depression demonstrated slower RTs for positive words and differed significantly from nondepressed individuals. In addition, depressed individuals took longer to respond to self-referential negative words than did nondepressed individuals. Moreover, moderator analyses revealed that only individuals in the clinical group (i.e., diagnosed with MDD with a standardized assessment), and not the nonclinical group, took significantly longer to respond to negative self-referential words than nondepressed individuals. Depressive-symptom severity also moderated this finding given that only individuals in the severe group took significantly longer to respond to negative self-referential words than nondepressed individuals. Thus, our findings may be best explained by depressed individuals overall taking longer to process information rather than difficulties processing positive information specifically.

These findings dovetail with existing research, which suggests that depressed individuals overall take longer

to respond to stimuli during cognitive tasks (Lawlor et al., 2020). Taken in concert with other findings that RTs overall on the SRET are poor predictors of depression severity (Dainer-Best, Lee, et al., 2018), our results suggest that RTs on the SRET are unlikely to yield meaningful endophenotypic indications of depression, unlike other attentional-bias tasks (i.e., Winer & Salem, 2016). Future studies seeking to investigate RTs within the SRET may opt for using the drift-rate-diffusion model, which encompasses both RT and endorsement and represents the ease that one can make a decision (Ratcliff & McKoon, 2008).

In sum, our constellation of findings across all of our analyses supports and extends prior research that has investigated how devaluation of positivity emerges in other types of biases. As stated previously, cognitive theories of research have emphasized the role of negative biases in the development of maintenance of depression. However, many meta-analyses have recently emerged that provide support for the role of devaluative biases as well. Indeed, prior meta-analytic work has found that depressed individuals demonstrate both devaluative and depressed processing regarding attentional biases (Winer & Salem, 2016), interpretational biases (Everaert et al., 2017), memory biases (Everaert et al., 2022), and emotion regulation (Bean et al., 2022). Thus, our findings provide further emphasis that depressed persons' biases should be investigated from both a reward-devaluation-theory and cognitive-theory lens.

Clinical implications

The current meta-analytic findings provide further support for a devaluative bias for positive self-referential information and heightened bias for negative self-referential information. Extant cognitive therapies, including cognitive behavioral therapy (CBT), effectively target depressed individuals' negative self-schemas by working to restructure cognitive distortions or irritational negative thoughts (e.g., "I can never do anything right"; Hofmann et al., 2012). Moreover, behavioral activation (BA) targets depressive symptoms by implementing activity scheduling to increase the number of pleasurable activities that depressed individuals may engage in (Cuijpers et al., 2007). Thus, there are several existing therapies that target depressive symptoms, with the former targeting negative biases specifically; however, individuals who are described as "treatment resistant" often do not respond well to CBT and BA because they continue to demonstrate impairment after treatment. In addition, biological therapies have also been established for individuals who are described as "treatment resistant," including electroconvulsive therapy, but these therapies often have harmful side effects, including memory loss (Conroy & Holtzheimer, 2021).

Whereas our results do confirm that depressed individuals have a greater negative self-schema than nondepressed individuals, our results also suggest that they have a reduced positive self-schema compared with nondepressed individuals. Furthermore, severely depressed individuals' self-schemas are predominantly organized by less positive views and more negative views (i.e., devaluative self-schemas). Given that individuals with severe depressive symptoms are more likely to be categorized as "treatment resistant" (Kornstein & Schneider, 2001), it is possible that their devaluative self-schemas may affect the effectiveness of CBT and BA.

A novel class of treatments, positive-affect treatments (PATs), targets deficits in positive affect, which may make such treatments effective for individuals with devaluative self-schemas (for a review, see Winer et al., 2019). These treatments place a specific emphasis on improving positive affect (and decreasing anhedonia) and well-being. There are several existing PATs that have demonstrated significant improvements in depressive symptoms and positive affect, including amplification of positivity (Taylor et al., 2017), PAT (Craske et al., 2019), and augmented-depression therapy (Dunn et al., 2019).

An important caveat regarding PATs, however, is that recent work has suggested that individuals who devalue positivity are actually less likely to want to engage in treatments targeting positive affect (Bryant et al., 2023). Thus, depressed individuals who devalue positivity, particularly people with more severe symptoms, may be more likely to have negative views about positivity (e.g., "happiness is only temporary") and thus believe that the treatments that aim to increase their positive affect will not be a good fit or be effective for them. Thus, although PATs appear promising for individuals with reduced positive affect, clinicians may have to provide extensive psychoeducation about reward devaluation and positive affect to increase client acceptance and reduce prospective dropout.

General strengths and limitations

One strength of the current article is the novel examination of self-referential processing (both within and between subjects) for depressed individuals. Our findings provide evidence that depressed individuals' self-schemas are organized with fewer positive connections and greater negative connections compared with nondepressed individuals and show that this relationship is absent when considering emotional content in relation to other individuals. This evidence of comparative self-other emotional salience has important clinical implications, as noted above.

The ability to interpret our findings was thus bolstered by our inclusion of other-referential meta-analyses because this allowed us to examine how depressed individuals differ in their processing of self- and other-referential emotional information. A third strength is the presence of moderator analyses, which demonstrated crucial information about how depressed individuals differ in processing self-referential information depending on their clinical status and symptom severity. In addition, we implemented transparent and thorough methods, including registering the protocol on PROSPERO and following PRISMA-P guidelines. These methods, in concert with our study-selection guidelines, data-synthesis strategy, and investigation of ROB, contributed to the overall strength of our current findings.

Despite the strengths of this article, there are important limitations to address. First, we had specific inclusion and exclusion criteria that resulted in a large number of studies being excluded from our analyses. However, we argue that the criteria established were necessary in validly capturing individual-level self-referential processing. For example, including studies that assessed for self-referential processing after a mood-induction procedure or treatment would likely not have captured individuals' true baseline self-referential processing. In addition, the moderator analyses may be thus underpowered because of the small number of samples; thus, the moderator analyses should be interpreted with caution. Second, the moderators examined in our analyses were not inclusive of all of the potential sources of heterogeneity in our findings, but we selected moderators that have been commonly used in other meta-analyses and that were most relevant for our research questions. Moreover, our moderator analyses may be underpowered given the small number of studies in some of the meta-analyses; thus, the moderator analyses should be interpreted with caution. Third, our other-referential analyses contained small numbers of samples given the lack of studies in the literature that have investigated other-referential processing. Although the current findings provide important information on how depressed individuals differ in their processing of self- and other-referential emotional information, our investigations are limited and should also be interpreted with caution. Thus, future studies are needed to better investigate this finding and whether these meta-analytic differences emerge with larger samples.

Conclusion

Our constellation of findings suggests that depressed individuals overall recalled fewer self-referential positive words than negative words. They also endorsed an equal number of positive words and negative words as self-referential, but individuals with severe symptoms of depression endorsed fewer positive words than negative words as self-referential, consistent with findings related to recall. Depressed individuals differed markedly in their processing of other-referential information given that they endorsed and recalled more other-referential positive words than negative words. They also endorsed fewer positive words and more negative words when describing themselves than when describing others compared with nondepressed control subjects. However, discriminating from self-referential words, we found that depressed individuals did not differ from nondepressed individuals on their processing of other-referential words.

Previous studies have emphasized the role of enhanced negativity and lack of positivity when depressed persons process and recall self-referential information. Our findings indicate that conceptualizing self-referential processing in depression as merely based on negativity biases can overlook crucial information about how depressed individuals devalue positive information that is self-relevant. Depressed individuals do not merely lack the ability to endorse and recall positive information in general; they systematically devalue positive information about themselves. Future research and interventions informed by our current findings may wish to focus less on nomothetic positivity dysfunction in depressed individuals and more on how and why depressed persons come to remember fewer positive things about themselves.

Transparency

Action Editor: DeMond M. Grant
Editor: Jennifer L. Tackett
Author Contributions

Amanda C. Collins: Conceptualization; Methodology; Formal analysis; Data curation; Writing – original draft; Writing – review & editing.

E. Samuel Winer: Conceptualization; Methodology; Writing – review & editing; Supervision.

Declaration of Conflicting Interests

The author(s) declared that there were no conflicts of interest with respect to the authorship or the publication of this article.

Open Practices

This article has received the badge for Preregistration. More information about the Open Practices badges can be found at http://www.psychologicalscience.org/publications/badges.

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Acknowledgments

We thank Hilary L. DeShong, Mary E. Dozier, Richard T. Liu, and Cliff McKinney for their very helpful comments on an early draft of this article. Portions of this articles were used as part of the A. C. Collins's dissertation.

Supplemental Material

Additional supporting information can be found at http://journals.sagepub.com/doi/suppl/10.1177/21677026231190390

Notes

1. Many studies also included a semantic condition; however, we discuss only self- and other-referential conditions given the current scope of this review.
2. It is important to address that some may view the current president as an "unfamiliar other" rather than a "familiar other" given that they do not know the president personally. In the current review, we consider the current president to be a "familiar other" based on prior work (Kelley et al., 2002).
3. We recommend that readers view the PROSPERO registration version for February 11, 2022, to view the registration before analyses.
4. We decided to exclude studies that are considered gray literature (e.g., student dissertations) given that these studies have not been rigorously peer reviewed by experts. Prior research has indicated that including dissertations in meta-analyses rarely affects the results and that meta-analyses conducted without dissertations often demonstrate a more conservative estimate compared with meta-analyses with dissertations included (Hartling et al., 2017; Vickers & Smith, 2000).
5. We did not include this exclusion criteria in the PROSPERO registration; however, we decided during the literature search that this should be excluded because of rating tasks involving a different level of processing compared with tasks that do not include ratings.
6. In the PROSPERO registration, we stated that studies would be "included if the task does not include positive stimuli." However, this was an error and should instead state that studies would be "*excluded* if the task does not include positive stimuli" because of our primary research questions focusing on processing of positive information.
7. The decision to handle studies in this manner was made after we completed the PROSPERO registration and was thus not included in the registration before analyses.
8. When more than two measures were administered that assessed for depressive symptoms, we included the measure that either best captured depression symptoms (e.g., full scale instead of subscale) or was most commonly used by other studies in this current study (i.e., BDI).
9. We included the robvis visualization tool in our preregistration; however, we did not go into detail in our preregistration regarding the procedure of using this and the ROBINS-I tool.
10. Some studies (e.g., Dalgleish et al., 2004) included two independent studies. Other studies, (e.g., Dainer-Best, Shumake, & Beevers, 2018) included two independent depressed samples. Each independent study and/or sample was included in our analyses.
11. Given that our primary research interests involved differences in processing for depressed individuals, we did not conduct additional moderator analyses for nondepressed within-subjects analyses.
12. Given that our primary research interests involved differences in processing for depressed individuals, we did not conduct additional moderator or publication-bias analyses for nondepressed within-subjects analyses.
13. Given that there were only two samples in the mild group, we conducted the moderator analyses for depressive-symptom severity again with only the moderate and severe groups included. This did not alter our findings; there were still no significant differences between the severity groups ($Q = 0.936$, $p = .333$).
14. We originally conducted this meta-analysis with all 22 samples, and the combined effect size was medium, negative, and significant ($k = 22$, $n = 550$, $g = -0.550$, $SE = 0.124$, $I^2 = 96.947$, $p < .001$), which was in the direction of our hypothesis. However, our results suggested that two studies demonstrated extremely large effect sizes ($gs = -10.64$ and -11.57). After discussion, we decided that these effect sizes could be potentially skewing the overall effect size of the meta-analysis. Thus, even though the two studies were in the direction of our hypothesis, we excluded these two studies and conducted the recall meta-analysis and moderator analyses again with the remaining 20 samples.
15. Given that there were only two samples in the mild group, we conducted the moderator analyses for depressive-symptom severity again with only the moderate and severe groups included. This did not alter our findings; there were still no significant differences between the severity groups ($Q = 0.139$, $p = .709$).
16. As noted above, two studies demonstrated outlier effect sizes. The combined effect size before excluding those two studies ($k = 19$) was large, positive, and significant ($k = 18$, $n = 887$, $g = 1.131$, $SE = 0.243$, $I^2 = 89.970$, $p < .001$), which was in the direction of our hypothesis.
17. We also compared the effect sizes between self-referential and other-referential conditions for endorsement and recall to further investigate how depressed individuals differ in their processing of the self and others (see Tables S9–S11 and Figures S30–S32 in the Supplemental Material).

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