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Cyber-Narcissism Across Space and Time:

A Meta-Analysis on Narcissism and Social Networking Behavior

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Abstract

The increasing popularity of social networking sites such as Facebook and Twitter has given rise to speculations that these platforms suit and reinforce narcissistic tendencies (cyber-narcissism). However, recent research on this issue has been all but conclusive. We present a multilevel, random-effects meta-analysis including 270 effect sizes (total N = 24,066) on the association between trait narcissism and social networking behavior. The meta-analysis identified a moderate effect of $\rho = .18$ ($\tau = .11$) for grandiose narcissism that replicated across different social networking behaviors, platforms, and across time. Moderator analyses revealed pronounced cultural differences with stronger associations in power distant cultures. Sensitivity analyses and tests for publication bias corroborated these results. Overall, the study supported but also refined the notion of a relationship between engaging in social networking sites and narcissistic personality traits.

Significance Statement

The relationship between narcissism and engagement in Social Networking Sites (SNSs) has attracted the attention of researchers and the general public alike. Original research has provided conflicting evidence. We provide the first data on the magnitude and variability of this relationship and further insight into moderators on the individual and cultural level. Our meta-analysis of 270 effect sizes on over 24,000 participants shows that individuals' grandiose (but not vulnerable) narcissism is positively related to activity on SNSs such as Facebook. This relationship holds for different behaviors, platforms, and over time. However, the size of this relationship increases with the power distance in a society.

Introduction

Social networking sites (SNSs) such as Facebook or Twitter have become an important part of the lives of hundreds of millions of users worldwide. Researchers and journalists have argued that the popularity of SNSs is fueled by users' narcissism (cyber-narcissism, 1) and that social networking behavior reinforces narcissistic tendencies. However, the existence and the boundary conditions of the link between SNSs use and narcissism is a matter of debate. Whereas some empirical studies found support for a positive relationship between narcissism and social networking behavior (2) other studies found mixed results (3) or even negative effects (4). The present work is the first to provide a comprehensive meta-analytic overview on the relationship between narcissism and social networking behavior.

The Narcissistic Personality

Since the late 19th century scientists interested in human experience and behavior described excessive self-love with the term narcissism (5), recurring to the mythological figure of *Narcissus* who—instead of accepting an approach by the nymph *Echo*—fell in love with his image that was reflected from a pond's surface. Narcissism is characterized by an inflated sense of the self and self-entitlement. Two distinct, albeit related forms of narcissism are documented (6): *Grandiose narcissism* involves a sense of self-importance, uniqueness, dominance, and grandiosity. *Vulnerable narcissism* is characterized by insecurity, interpersonal hypersensitivity, and social withdrawal (for a discussion on the narcissist personality disorder, NPD, which is not focused in the present study, see for example 7). Individuals with a pronounced grandiose narcissism (the form that has received more attention in recent years) perceive themselves as gifted, remarkable, and successful,

and individuals high in grandiose narcissism engage in active self-presentation (they tend to brag about their accomplishments, cf. 8). These individuals need others in order to demonstrate their high and superior qualities and achievements (9). Narcissists' high self-esteem is rather unstable and narcissists are more likely to react aggressively when they are faced with threats to their embellished self-concepts. Cultural influences are considered to play a substantial role in the development and maintenance of a narcissistic self. Initial studies that compared narcissism in different world regions suggest that narcissism is more prevalent in individualistic cultures (USA and to a lesser extent Europe) than in collectivistic cultures (Asia; 10, 11). Researchers further identified an increase in narcissism across time ("generation me", 12; for opposing positions see for example 13).

Narcissism in the Digital Age

Differences in narcissism across regions and time have been connected to the prevalent media culture, which is considered to reflect and shape individuals' narcissism (14). In many cultures and world regions, the engagement in SNSs has become an immensely popular pastime activity. Recent data from national surveys suggest that nearly 76% of all Internet users in the United States are active in SNSs (15). Since the early days, concerns have been raised that Facebook is a playground that promotes narcissistic tendencies by encouraging users to present themselves frequently and in most positive ways (16, 17). Indeed, SNSs entail particular features of communication that differ from offline communication (18), and that might suit narcissistic tendencies. First, SNSs provide easy *access* to a large number of other individuals. Users have the opportunity to send self-related information to a large audience and to receive feedback about oneself and information about others. Second, SNSs provide partial or complete *anonymity.* Users can

rather freely choose which information they present about themselves given the smaller likelihood that the presented information is scrutinized for consistency with true characteristics or achievements. Third, the *asynchronicity* of communication on SNSs gives users the opportunity to craft their self-presentations meticulously.

The first study on the relationship between SNSs use and narcissism (16) showed that users' self-reported grandiose narcissism was significantly related to the quantity of their social interactions (a composite measure of number of friends and number of wall posts) but not to the quantity of information listed in the "about self" section. Moreover, the researchers rated the extent of self-promoting content (mainly self-promotion in pictures and quotes) on the participants' Facebook pages and correlated these ratings with self-reported grandiose narcissism. Several, but not all of the Facebook content indicators yielded a positive relationship with self-reported narcissism (e.g., main photo self-promotion, overall narcissist impression).

When this seminal study was submitted, Facebook had around 29 million active users—which are around 2% of its current active membership. Since then, a sizeable research on the link between SNSs and narcissism was conducted, paralleled by substantial media coverage on the topic. To date the available research is spread through different disciplines and remains somewhat inconclusive: Whereas many studies have supported the notion of a positive relationship between grandiose narcissism and the number of contacts on SNSs (2, 3), others found no (19, 20) or reversed relationships (4, 21). Similarly, whereas some narrative reviews in the field tend to emphasize the narcissism–SNSs link (14), others assess the connection to be non-established (22).

The Current Meta-Analysis

This meta-analysis is the first quantitative summary of prior findings on the relationship between narcissism and social networking behavior. Two general aims guided the research. On the one hand, we sought to provide meta-analytical evidence regarding the magnitude and variability of the relationship between SNSs behavior and narcissism. On the other hand, we examined the boundary conditions of the SNS-narcissism link. Four hypotheses guided this approach. First, two forms of narcissism were distinguished. Whereas the opportunities for self-presentation provided by SNSs (18) suit individuals with pronounced grandiose narcissism, it was expected that SNS activities were less attractive for individuals with pronounced vulnerable narcissism. Thus, a stronger relationship was expected between SNS behaviors and grandiose narcissism than between SNS behaviors and vulnerable narcissism (Hypothesis 1). Second, several indicators of SNS behaviors were used in prior research. It was expected that grandiose narcissism would be more closely related to activities reflecting self-presentation online (e.g., status updates, posting photos) than to broad indicators of engagement in SNSs (e.g., time spent with SNSs; check-in frequency; Hypothesis 2). The latter indicators include activities that might not be particularly attractive to narcissists (e.g., watching videos, playing games, lurking). Third, it was examined whether the size of the relationship between narcissism and SNSs behaviors changed over time. Early adopters of new technologies frequently attract people with rather unique characteristics (see the role of trendsetting and opinion leadership in the diffusion of innovations; 23). The soaring popularity of SNSs in the general public (15) and a boost in narcissism scores over time (12, 24), led to the assumption that narcissists might have increasingly discovered SNSs as an easy opportunity for self-presentation which is

reflected by a strengthening of the narcissism-SNSs link over time (Hypothesis 3). Finally, the cultural background of the study participants was examined. Prior research indicates that members of collectivistic countries (e.g., Asia, Middle East) are on average more hesitant to engage in self-presentation online than members of individualistic cultures (e.g., United States, Canada, or Western Europe; cf. 25). In these cultures narcissism might be particularly predictive of engaging in SNS. Individuals with low narcissism in these cultures are likely to have a particularly low motivation to engage in SNS at all; for narcissists, however, SNS activities might be a sought after opportunity to communicate outside the cohesive structure of community and family (26). Likewise, prior theory and research suggests that in cultures that value pronounced social hierarchies and an unequal power distribution among their members (high power distance; 27) SNSs might provide a particularly rare and welcome opportunity for narcissistic individuals for standing out and presenting oneself, independent of their actual social standing in the society (25). Thus, it was hypothesized that the link between SNS behaviors and grandiose narcissism would increase with the power distance (Hypothesis 4a) and the degree of collectivism (Hypothesis 4b) in the participants' culture.

Results

Descriptive Statistics

The meta-analytic database comprised 58 independent samples from 53 studies published between 2008 and 2015. Most studies were reported either in peer-reviewed journal articles (71%) or in books (2%); unpublished work appeared in theses (21%), conference proceedings, and unpublished research reports (7%). The total number of reported correlation coefficients was 270, with each sample contributing between 1 and 32

(*Mdn* = 3) correlations. The meta-analysis involved 24,066 participants (range of the individual samples' *N*s: 31 to 2,927) from 15 countries. About 52% of all samples originated from the United States, 19% from Europe, and 16% from Asia. Approximately 61% of the participants were female and the mean age of the samples ranged from 14 to 35 years (*M* = 22.91, *SD* = 4.85). Most correlations (84%) involved variants of the Narcissistic Personality Inventory (28), whereas the remaining correlations used a variety of specialized instruments. Among the diverse SNSs Facebook (61%) and Twitter (15%) dominated the observed correlations; the rest referred to generic SNSs (8%) or various regional or special-purpose platforms such as MySpace, Instagram, or Weibo.

Overall Pooled Correlation

The results of the meta-analysis are summarized in Table 1. The uncorrected mean correlation between narcissism and SNS behavior was $r = .13$ ($SD = .13$). After correction for sampling and measurement error the respective correlation increased to $\rho = .18$ ($\tau = .11$). This result was rather robust and also replicated for various subgroups of effects. For example, studies examining Facebook exhibited a pooled correlation of $\rho = .18$ ($\tau = .13$) and those focusing on Twitter a pooled correlation of $\rho = .18$ ($\tau = .05$). Similarly, grouping the effects by the type of SNS behavior resulted in effects around .18 (see Table 1). However, one subgroup showed markedly larger correlations: Effect sizes focusing on usage intensity (as assessed by the Facebook Intensity Scale; 29) resulted in slightly larger pooled correlations of $\rho = .26$ ($\tau = .12$). This suggests that the type of the examined social networking behavior might represent a relevant moderator of narcissism's consequences.

Overall, these results support the hypothesized effect between grandiose narcissism and social networking behaviors. However, the I^2 indices around .40 also point at moderate unaccounted heterogeneity (30) that might be explained by one or more moderators.

Moderator Analyses

The four hypotheses regarding moderating effects were examined by regressing the individual effect sizes on the moderating variables (see method section). To correct for measurement errors all regressions also included the unreliability of the narcissism scale as additional predictor.

Type of narcissism. The first hypothesis assumed that the association between narcissism and SNS behaviors would be larger for grandiose narcissism than for vulnerable narcissism. A respective regression analysis using the type of narcissism (coded 1 for grandiose and -1 for vulnerable) as a predictor of the individual correlations resulted in a significant effect, $\gamma = 0.05$, $SE = 0.02$, $p = .02$. In line with Hypothesis 1, the effect for grandiose narcissism $\rho = .18$ ($\tau = .11$), $p < .001$, was larger than the effect for vulnerable narcissism $\rho = .08$ ($\tau = .14$), $p = .28$ (see Table 1). However, for vulnerable narcissism only four samples were available. Therefore, these results should be considered exploratory unless a larger body of effects can be examined. In light of the divergent associations of the two forms of narcissism, the following moderator analyses are limited to the 57 samples involving grandiose narcissism.

Type of social networking behavior. It was expected that narcissism would be more strongly correlated to behaviors gearing towards self-presentations such as enhancing one's profile or posting status updates as compared to overall usage indicators. To this end the effect sizes were regressed on two dummy-coded variables indicating either the usage

intensity or the number of friends as compared to self-presentations. Whereas the latter indicator revealed no significant effect, $\gamma = 0.01$, $SE = 0.02$, $p = .95$, the effect for the former was marginally significant at $\gamma = -0.03$, $SE = 0.02$, $p = .054$ (see Supplement E). Together, the two indicators explained about 12% of the random variance. These results offer weak support for different behavioral associations (Hypothesis 2).

Publication year. The third hypotheses assumed time trends for the association between SNS behaviors and trait narcissism A respective meta-regression model for the publication year identified neither linear, $\gamma = 0.00$, $SE = 0.01$, $p = .95$, nor quadratic, $\gamma = 0.00$, $SE = 0.00$, $p = .52$, changes over time. In contrast to Hypothesis 3, cyber-narcissism was rather stable across the examined time span.

Culture. Cross-cultural differences in narcissism's effects were examined by regressing the effect sizes on the scores for power distance, individualism, masculinity, and uncertainty avoidance. Four heterogeneous Internet samples including 16 effect sizes were excluded from these analyses because their participants came from diverse world regions. The association between narcissism and SNS behavior was significantly, $\gamma = 0.03$, $SE = 0.02$, $p = .04$, affected by the countries' power distance (Hypothesis 4a), whereas individualism (Hypothesis 4b), $\gamma = 0.01$, $SE = 0.01$, $p = .31$, did not moderate the effect (Supplement E). Countries with larger power distance such as China or India exhibited larger associations between narcissism and SNS behavior than low or medium power distance countries such as Austria or the United States (see Figure 1). The other cultural dimensions showed no moderating effects, all ps $> .30$. Together, culture explained about 14% of random between-sample variance.

Further explorations

Although we had no a priori hypotheses regarding potential effects, we examined several further variables to study the pooled effect across a variety of conditions: the percentage of female respondents, the mean age (in years), the administered narcissism scale, the construct specificity (i.e. the global narcissism trait versus a specific facet such as entitlement or authority; cf. 28), and the studied SNS. After controlling for these variables the intercept and, thus, the pooled correlation amounted to .16, $p < .001$, and was not considerably different than the pooled correlation that did not control for these covariates (Supplement F). Moreover, none of the examined variables showed a significant, $p < .05$, effect on the pooled correlation.

Sensitivity Analyses

In order to determine the robustness of the previously presented results extreme correlations (i.e. outliers) were removed from the meta-analytic database to compare the pooled effect to the pooled effect from the full database. For the total set of effects six correlations were identified as potential outliers. However, after eliminating theses effects from the database the pooled effect did not change and remained (with and without outliers) at $\rho = .18$. Although the random variance reduced slightly, the extreme correlations did not distort the pooled correlation. Similar patterns also emerged for most subgroup analyses (see Supplement G). One notable exception was the correlation between grandiose narcissism and the number of friends. After removing one outlier the pooled correlation increased from .20 to .26. Thus, the outlier seemed to suppress the true effect slightly. Overall, the outlier analyses corroborated the previously identified association between grandiose narcissism and social networking behaviors.

Publication Bias

To determine a potential publication bias, effect sizes extracted from published sources (i.e. journal articles and books) were compared to effects from unpublished sources (i.e. conference proceedings, research reports, and theses). The moderator analysis identified significantly, $\gamma = .05$, $SE = .01$, $p < .001$, smaller effects for unpublished, $\rho = .12$ ($\tau = .13$), $p = .06$, as compared to published effect sizes, $\rho = .21$ ($\tau = .11$), $p < .001$. Thus, published research findings seem to be systematically biased due to file-drawer studies with small effects. Whether this distortion also affected our meta-analytic database was tested within the PET-PEESE framework (31). These analyses identified a largely symmetric funnel plot (see Supplement H) and no distortions due to a publication bias. Moreover, the PET-PEESE analyses estimated a pooled effect corrected for publication bias of .18 and thus replicated the previously reported results. Finally, *p*-curve analyses provided evidence for the examined effect as a true phenomenon and not as a result of intense *p*-hacking. Thus, publication bias did not seem to have distorted the previously presented analyses.

Discussion

Today, around two thirds of all adults in the United States use social networking sites regularly (15). The fast growing popularity of SNSs has been accompanied by worries in popular science books and the mainstream media that these platforms reflect and fuel narcissistic tendencies (cyber-narcissism). At the same time researchers worldwide have gathered a substantial amount of data. A little more than ten years after the founding of Facebook it is time to take stock: What do we know about the relationship between SNS behavior and narcissism? The present meta-analysis identified an overall relationship between SNS behaviors and grandiose narcissism of $\rho = .18$, a relationship of medium size

as compared to similar effects typically found in applied psychological sciences (32). This effect was rather robust and replicated across a variety of conditions: Narcissism was equally predictive of general intensity of use (e.g., time spent) and behaviors that provide particular opportunities for self-presentation (e.g., posting photos, status updates). A relationship of similar size was found when the number of SNS contacts (e.g., Facebook friends or Twitter followers) was addressed. The relationship also held across different SNS platforms (e.g., Facebook vs. Twitter) and no difference was found between early and more recent studies. Thus, the pattern of effects supports the claim that SNS behavior reflects individuals' narcissism.

Cyber-Narcissism around the Globe

Narcissistic tendencies are not equally distributed across different societies and even within countries between different ethnic groups (10). Therefore, this study sought to examine whether cyber-narcissism was equally susceptible to cross-country variations. Our meta-analysis involved data from 15 countries of four different continents (currently 83% of all Facebook users are located outside the US). We observed that the size of the SNS-grandiose narcissism link varies with the cultural background. Whereas cyber-narcissism was comparable in individualistic and collectivistic countries, the SNS behavior-narcissism link was particularly strong in societies in which social stratification is considered to be fixed and where citizens' place in a society appears to be a given—countries with a large power distance (27). In these countries SNSs provide rare opportunities to express self-entitlement and uniqueness and are therefore relatively more attractive for grandiose narcissists (26). However, a cautionary note is warranted: In cross-cultural research disentangling cultural effects from economic and other societal influences is a challenge

because cultural indicators are highly correlated to various indicators of economic wealth and prosperity[*]. This caveat notwithstanding, our results indicate that pronounced differences in cyber-narcissism exist across countries.

The Narcissism-SNSs Conundrum

Do narcissists seek out SNSs or do SNSs reinforce narcissistic tendencies? Most of the available research was guided by the former assumption (3, 20): SNSs such as Facebook are thought to act as platforms for people to enact their narcissistic tendencies, such as posting self-promoting status updates or photos. Recent longitudinal analyses corroborated this view and showed that narcissism prospectively predicted Facebook use over time (at least for men), whereas a reverse effect was not found (33). In contrast, some authors speculated that social media might also be a cause of narcissism and contribute to the spreading narcissistic behaviors in today's societies (34): Experimental studies observed increased narcissism scores after participants interacted with their own SNSs profile; thus, the intense self-focus initiated by many SNS activities also seems to promote users' narcissism. Taken together, these results indicate that the relationship between narcissism and SNS behavior likely follows the pattern of a reinforcing spiral (35): Individual dispositions guide media-related behavior and engaging with the media in turn reinforces the dispositions.

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[*] For the countries included in our meta-analytic database power distance and individualism correlated at r = .80 and r = .78 with the Gross Domestic Product (GDP). Therefore, it did not seem feasible to include the GDP as an additional covariate in our moderator analyses. However, a moderator analysis using the GDP as predictor of the individual effect sizes did not reveal a significant effect, $\gamma = -0.05$, $SE = 0.03$, $p = .08$.

Limitations

Several open questions remain. First, the presented results primarily pertain to grandiose narcissism; research on the vulnerable form of narcissism is sparse. The present review identified only four studies reporting on the link between vulnerable narcissism and SNSs behaviors, clearly more studies in this regard are needed. Second, this review focused on self-assessed narcissistic tendencies. In light of increasing evidence that peer reports from knowledgeable others exhibit incremental validity in predicting various behavioral outcomes (36) it seems worthwhile to replicate the presented findings by contrasting self- and peer perspectives. Third, longitudinal studies are missing that disentangle the patterns of causal influence over time and potentially corroborate the assumption of an interplay between narcissism and SNSs use in the form of a reinforcing spiral (35). Finally, our meta-analytical finding that the link between narcissism and SNS behavior grows stronger with a society's power distance is intriguing. Further cross-cultural studies are needed to derive a broader understanding of the interplay between media cultures and other cultural influences.

Conclusion

In summary, cyber-narcissism proves to be a phenomenon that is supported by empirical research. It does not vary with the platform (Facebook vs. Twitter), with the behavior indicators, demographics of the sample, or with the year the study was conducted. It is, however, restricted to the grandiose form of narcissism and it fluctuates with the power distance in a culture.

Method

Meta-Analytic Database

Search process. In search for relevant studies for the meta-analysis various scientific databases (*PsycINFO*, *Psyndex*, *Psychology & Behavioral Sciences Collection*) were inspected and searched for the keywords *narcissism* and *social networking*, *Facebook*, or *Twitter*. Studies were further retrieved by conducting a similar search in the *ProQuest Dissertations & Theses Database* and *Google Scholar*.

Studies were included in the meta-analytic database dependent upon the following conditions: (a) The study was published between 2004 (the founding year of Facebook) and August 2015, and (b) was written in English or German. (c) The study administered a validated instrument assessing trait narcissism. Ad-hoc constructed scales were excluded to avoid biases resulting from unreliable scales lacking construct validities. (d) Narcissism was measured as a self-report. Studies that collected observer reports or inferred narcissism from thin slices of behavior were excluded. (e) The study examined social networking *behaviors* such as durations (e.g., usage time per day), frequencies (e.g., number of logins, friends or postings), text lengths (e.g., number of words in a profile), or intensity ratings (e.g., the Facebook Intensity Scale; 29). Studies that exclusively reported evaluative components of social networking such as attitudes, motives, or emotional experiences were excluded. (f) The study reported correlations between narcissism and SNS behaviors or appropriate statistics that could be transformed into correlations. (g) The study provided the sample size and (h) consisted of healthy individuals at least 13 years of age (the required minimum age of Facebook). Studies on children or clinical populations (e.g., with narcissistic personality disorders) were not considered. The entire search process and the

list of studies that were excluded from the meta-analytic database according to these rules are documented in Supplements A to C.

Coding process. Several variables were extracted from each study. The focal variable was the association between narcissism and SNS behaviors. In addition, the size of the examined sample and the coefficient alpha reliability of the narcissism scale were recorded. Moreover, we coded several moderators according to our hypotheses: (a) Following Miller and colleagues (6) the type of the operationalized narcissism construct was coded as grandiose versus vulnerable. Instruments that were not included in this classification scheme were categorized by two subject experts. (b) Furthermore the specific indicator used to quantify SNS behaviors was coded into three categories reflecting the usage intensity (number of check-ins, average time spent, Facebook intensity), self-presentation behaviors (status updates, photos), and the number of friends. (c) The publication year was used to examine changes over time. (d) To account for the participants' cultural origin, we first recorded the country where the participants originated from. Subsequently the respective culture scores for the four primary dimensions of culture (27), that is, power distance (the extent to which a society accepts inequalities and hierarchies among their people), individualism (the degree of autonomy and self-actualization as compared to interrelatedness), masculinity (the amount of prevalent emotional values from modest and caring to assertive and competitive), and uncertainty avoidance (the tendency towards tolerance towards ambiguity and lack of structure) were allotted for each country. These culture scores range from 0 to 100 and reflect the relative standing of each country on the respective dimension. Further details regarding the coding process are described in Supplement D.

Missing values. For studies that did not report all necessary information, missing values were imputed using the median value of the remaining studies. Thus, the reliability of the narcissism scale had to be imputed for about 24% of the effects. To account for instrument-specific reliability differences missing reliabilities were imputed stratified by the 40 items (28) and the 16 items (37) version of the Narcissistic Personality Inventory. For the remaining instruments the median reliability of all reported values was imputed.

Meta-Analytic Procedure

Effect size. The Pearson product moment correlation was used as effect size measure. For studies that did not report correlations the standardized regression weight was used. If narcissism was the single predictor of social networking behavior we used the untransformed regression weight, whereas a transformation formula (see 38) was applied to approximatively convert regression coefficients from multiple regression analyses into correlations. Extreme correlations were identified using the studentized deleted residual (α = .01; 39). The impact of these outliers on the pooled effects was examined in sensitivity analyses that removed the identified outliers from the analyses.

Meta-analytic model. The effect sizes were pooled using a random effects model with a maximum likelihood estimator (40). Because some studies provided more than one effect size (e.g., obtained for different social networking behaviors) the meta-analysis was formulated as a multilevel model (41). Multilevel meta-analyses acknowledge dependencies between effect sizes stemming from the same sample and, thus, estimate two random variance components: The random level 2 variance $\tau^2_{(2)}$ reflects the heterogeneity of effects within samples, whereas the random level 3 variance $\tau^2_{(3)}$ indicates the heterogeneity of effect sizes between samples. The heterogeneity in observed effect sizes

was also quantified by I^2 indicating the percentage of the total variance in observed effects due to random variance (30). Moderating effects on the pooled effect size were examined using weighted, mixed-effects regression analyses.

Correction for artifacts. The effect sizes were corrected for two sources of error: First, sampling error was accounted for by weighting the individual correlations by the inverse of their variances. Second, the pooled effect was corrected for measurement error in the narcissism scales using a regression approach (42). Thus, the unreliability (i.e. 1 minus the coefficient alpha reliability) of the narcissism scale was used as a predictor of the individual effect sizes. The intercept in the respective regression model represents the pooled effect corrected for measurement error. Because rather few studies reported the reliability of the examined SNSs behaviors, comparable corrections were not applied for this variable.

Publication Bias

Presence and consequences of publication bias were examined in three ways. First, the publication type was used as a moderator in a respective regression analysis. Significant differences in the pooled effects derived from published and unpublished sources would indicate that the published research literature is distorted due to the systematic suppression of (most likely small) effects. Second, PET-PEESE analyses (31) tested the funnel plot of the effects sizes in our meta-analytic database (i.e. including published and unpublished effects) for asymmetry by regressing the effect sizes on their standard errors or variances. A significant effect would indicate systematically missing studies that might have distorted the pooled effect. Third, *p*-curve analyses (43) determined whether the published findings provide evidence for a true phenomenon or more likely reflect an artifact of publication

bias and questionable research practices such as *p*-hacking (e.g., excluding participants or selectively reporting variables to achieve significant results).

Statistical Software and Open Data

All meta-analytic models were estimated with the *metaSEM* software version 0.9.4 (40). Additional analyses were conducted in *R* version 3.2.1 (44). The raw data including the *R* syntax files are available at

https://osf.io/5qde9/?view_only=dd3f2e63f0b4435294d84d152f211e12

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Figure Legends

Figure 1. Effect of power distance on the correlation between grandiose narcissism and social networking behavior. Letters indicate the pooled effects within countries; the font sizes correspond to the number of included samples. The solid line represents the regression line from Supplement E.

Table 1.

Meta-Analysis of Narcissism and Social Networking Behavior

	k_1	k_2	N	r	SD_r	ρ	SE_ρ	95% CI	$\tau_{(2)}$	$\tau_{(3)}$	$I^2_{(2)}$	$I^2_{(3)}$	80% CRI
Overall	270	58	24,066	.13	.13	.18*	.02	[.14, .22]	.08*	.08*	.43	.40	[.03, 32]
Type of narcissism													
Grandiose narcissism	256	57	23,892	.14	.13	.18*	.02	[.14, .23]	.08*	.08*	.40	.44	[.04, .33]
Vulnerable narcissism	14	4	602	.10	.17	.08 [d]	.08	[-.07, .24]	.00	.14	.00	.73	[-.10, .26]
Type of SNS [a]													
Facebook	159	42	13,248	.13	.15	.18*	.03	[.12, .24]	.09*	.09*	.43	.41	[.02, .34]
Twitter	40	8	5,668	.14	.08	.18*	.03	[.12, .23]	.05	.01	.53	.01	[.12, .24]
Other	57	16	8,050	.14	.11	.22*	.06	[.10, .34]	.06*	.07	.36	.46	[.10, .34]
Type of behavior [a]													
Self-presentation [b]	95	33	14,005	.15	.11	.19*	.02	[.14, .24]	.06*	.06	.38	.38	[.08, .30]
Number of friends	40	31	13,364	.14	.18	.20*	.06	[.08, .32]	.09	.10	.40	.49	[.02, .38]
Frequency of check-ins	29	12	4,205	.15	.13	.18*	.07	[.03, .32]	.00	.14	.00	.79	[.00, .35]
Usage duration	25	20	6,807	.11	.16	.15*	.04	[.07, .24]	.00	.15*	.00	.91	[-.04, .35]
Usage intensity [c]	11	8	1,876	.16	.17	.26*	.10	[.06, .46]	.12	.00	.74	.00	[.10, .41]
World region [a]													
North America	166	30	10,498	.14	.12	.19*	.02	[.14, .23]	.06*	.09*	.28	.53	[.05, .32]
Europe	35	11	2,295	.13	.16	.23*	.11	[.01, .44]	.12*	.05	.64	.13	[.06, .40]
Asia	29	9	4,792	.16	.13	.25*	.08	[.09, .41]	.09*	.06	.60	.26	[.11, .38]

Note. k_1 = Number of effect sizes; k_2 = Number of samples; N = Total sample size; ρ = Pooled correlation corrected for artifacts; SE_ρ = Standard error of ρ; 95% CI = 95% confidence interval of ρ; τ^2 = Random variance of ρ at level 2 or 3; I^2 = Proportion of total variance in r due to random variance (Cheung, 2014); 80% CRI = 80% credibility interval of ρ; [a] Based on grandiose narcissism scales; [b] such as uploading photos, commenting, or updating the profile; [c] as measured with the Facebook Intensity Scale (Ellison et al., 2007); [d] Includes only corrections for sampling error but not for measurement error.

* $p < .05$

Online Supplement for "Cyber-Narcissism Across Space and Time: A Meta-Analysis on Narcissism and Social Networking Behavior"

The data and syntax files are available at

https://osf.io/5qde9/?view_only=dd3f2e63f0b4435294d84d152f211e12

Supplement A: Summary of search process

Primary studies were identified from searches in *PsycINFO*, *Psyndex*, *Psychology & Behavioral Sciences Collection*, *ProQuest Dissertations & Theses Database*, and *Google Scholar* using the keywords *narcissism* and *social networking*, *Facebook*, or *Twitter*. Because the Google search algorithm ranks search results by importance (Brin & Page, 1988) and, thus, presents the most relevant studies among the first results the respective search was limited to the first 500 references (for a similar approach see Gnambs & Kaspar, 2014). After applying the predefined inclusion criteria (see main text) this search resulted in 49 eligible publications:

Identified studies:	
From scientific databases	76
From ProQuest database	124
From Google Scholar	500
Considered relevant after screening of title and abstract	89
Excluded studies:	
Not published between 2004 and 2015 (criterion A)	0
Not written in English or German (criterion B)	0
No validated narcissism scale (criterion C)	5
No self-reported narcissism scale (criterion D)	0
No social networking behavior (criterion E)	19
Not effect size reported (criterion F)	12
No sample size reported (criterion G)	0
Children or clinical population (criterion H)	0
Included studies:	53

Note. All excluded studies are listed in Supplement B.

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Supplement B: Studies excluded from the meta-analysis

Study	Reason
Ahn, Kwolek, & Bowman (2015)	No social networking behavior
Ang, Tan, & Mansor (2011)	No social networking behavior
Back, Schmukle, & Egloff (2008)	No social networking behavior
Bibby (2008)	No social networking behavior
Blaising (2015)	No effect size reported
Blumer (2012)	No social networking behavior
Boswell (2012)	No validated narcissism scale
Brown & Bobkowski (2011)	No effect size reported
Buckles, Trapnell, & Paulhus (2014)	No social networking behavior
Buffardi (2011)	No effect size reported
Clifton (2011)	No effect sizes reported
DeWall, Buffardi, Bonser, & Campbell (2011)	No social networking behavior
Ekşi (2012)	No social networking behavior
Fanti, Demetriou, & Hawa (2012)	No social networking behavior
Forsberg (2014)	No effect size reported
Horton, Reid, Barber, Miracle, & Green (2014)	No narcissism trait
Huang & Liu (2012)	No social networking behavior
Huling (2011)	No social networking behavior
Kim, Namkoong, Ku, & Kim (2008)	No social networking behavior
Liu, Ang, & Lwin (2013)	No social networking behavior
Livingstone (2008)	No effect size reported
Ljepava, Orr, Locke, & Ross (2013)	No social networking behavior
Lyons, Mehl, & Pennebaker (2006)	No validated narcissism scale
Marcus, Machilek, & Schütz (2006)	No social networking behavior
Marshall, Lefringhausen, & Ferenci (2015)	No effect size reported
Menard & Pincus (2012)	No social networking behavior
Nadkarni & Hofmann (2012)	No effect size reported
Odaci & Çelik (2013)	No social networking behavior
Rodman & Fry (2009)	No effect size reported
Ryan & Xenos (2011)	No social networking behavior

Study	Reason
Saad (2012)	No effect size reported
Shi, Yue, & He (2013)	No validated narcissism scale
Smith-Duff (2013)	No validated narcissism scale
Sorokowski et al. (2015)	No effect size reported
Tobin (2014)	No social networking behavior
Weathers (2013)	No effect sizes reported
Yue, Shi, & Cai (2013)	Unclear description of measures

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Supplement D: The coding process

Three raters extracted a number of variables from each study that referred to general study characteristics, sample characteristics, information about the narcissism scale, the social networking behavior, and the effect size. The complete coding guide including all variables is available on request from the first author. All coding was reviewed by the first author. The focal variables used for the meta-analysis were:

	General study characteristics
1.	Citation of the publication
2.	Publication year
3.	Format of the study publication (e.g., journal article, book, thesis, unpublished research reports, or conference proceedings)
	Sample characteristics
4.	Sample size
5.	Mean age of respondents (in years)
6.	Percentage of female participants
7.	Country of origin for participants
	Information on the narcissism scale
8.	Name of the administered narcissism scale
9.	Type of narcissism scale (i.e. vulnerable or grandiose)
10.	Construct specificity (i.e. global trait or facet)
11.	Coefficient alpha reliability of the narcissism scale
	Information on the social networking behavior
12.	Name of the social networking platform
13.	Description of the SNS behavior
14.	Type of SNS behavior (i.e., self-presentation, number of friends, number of check-ins, average time spent, Facebook intensity)
15.	Coefficient alpha reliability of the narcissism scale
	Effect size
16.	The correlation between narcissism and SNS behavior
17.	Any statistic that could be used to reproduce a correlation

Supplement E: Moderator Analyses

Moderating Effects of the Association between Grandiose Narcissism and Social Networking Behavior

		Model 1: SNSs behaviors			Model 2: Publication year			Model 3: Culture		
		γ	SE_γ	*z*	γ	SE_γ	*z*	γ	SE_γ	*z*
	Intercept	0.20*	0.02	8.35	0.18*	0.02	7.09	0.18*	0.03	6.40
1.	Unreliability [a]	-0.14*	0.07	-2.12	-0.15*	0.07	-2.17	-0.15*	0.07	-2.23
2.	Usage intensity [b]	-0.03	0.02	-1.93+						
3.	Number of friends [b]	0.01	0.02	0.29						
4a.	Publication year [c]: linear				0.00	0.01	0.06			
4b.	quadratic				0.00	0.00	0.65			
5.	Power distance [d]							0.03*	0.02	2.04
6.	Individualism [d]							0.01	0.01	1.01
7.	Masculinity [d]							0.01	0.01	0.48
8.	Uncertainty avoidance [d]							0.01	0.01	0.98
	$\tau_{(2)}$ / $\tau_{(3)}$	0.07* / 0.09*			0.08* / 0.08*			0.07* / 0.08*		
	$R^2_{(2)}$ / $R^2_{(3)}$	.12 / .00			.03 / .08			.05 / .14		
	k_1 / k_2	220 / 57			256 / 57			240 / 53		

Note. γ = Fixed effects regression weight; SE_γ = Standard error of γ; τ^2 = Random variance of ρ at level 2 or 3; R^2 = Proportion of explained random variance (Cheung, 2014); k_1 = Number of effect sizes; k_2 = Number of samples. Codings: [a] 1 – coefficient alpha; [b] Dummy coded as usage intensity or number of friends as compared to self-presentation; [c] Centered at the year 2012; [d] Rescaled to the interval [-5, 5].

* $p < .05$; + $p < .10$

Supplement F: Sensitivity Analyses

Exploratory Moderator Analyses

		γ	SE_γ	z
	Intercept	.16*	.03	5.81
1.	Unreliability [a]	-.11	.08	-1.44
2.	Sex of respondents [b]	-.00	.00	-0.88
3.	Age of respondents [c]	.00	.00	1.18
4.	Narcissism instrument [d]	.00	.02	0.01
5.	Construct specificity [e]	.02	.01	1.52
6.	Social networking site [f]	-.00	.02	-0.04
	$\tau_{(2)}$ / $\tau_{(3)}$	0.08* / 0.08*		
	$R^2_{(2)}$ / $R^2_{(3)}$	.03 / .18		
	k_1 / k_2	256 / 57		

Note. γ = Fixed effects regression weight; SE_γ = Standard error of γ; τ^2 = Random variance of ρ at level 2 or 3; R^2 = Proportion of explained random variance (Cheung, 2014); k_1 = Number of effect sizes; k_2 = Number of samples. Codings: [a] 1 – coefficient alpha; [b] centered at 50 percent; [c] centered at age 20; [d] 1 = Narcissistic Personality Instrument (Raskin & Terry, 1988) versus -1 = other instrument; [e] 1 = global trait versus -1 = facet; [f] 1 = Facebook versus 0 = other SNSs.

* $p < .05$; + $p < .10$

Supplement G: Meta-analyses without outliers

	k_o	ρ_o	SE_o	95% CI	$\tau_{o(2)}$	$\tau_{o(3)}$	$I^2_{o(2)}$	$I^2_{o(3)}$	80% CRI
Overall	6	.18*	.02	[.14, .21]	.07*	.05*	.52	.24	[.06, 29]
Type of narcissism									
Grandiose narcissism	6	.18*	.02	[.15, .22]	.07*	.06*	.48	.29	[.07, .30]
Vulnerable narcissism	0	.08 [d]	.08	[-.07, .24]	.00	.14	.00	.73	[-.10, .26]
Type of SNS [a]									
Facebook	6	.19*	.02	[.14, .23]	.08*	.05	.54	.22	[.06, .31]
Twitter	0	.18*	.03	[.12, .23]	.05	.01	.53	.01	[.12, .24]
Other	1	.22*	.06	[.10, .33]	.06*	.06	.37	.42	[.10, .33]
Type of behavior [a]									
Self-presentation [b]	2	.19*	.02	[.15, .23]	.05*	.04	.41	.25	[.11, .27]
Number of friends	1	.26*	.06	[.15, .37]	.10	.00	.80	.00	[.13, .39]
Frequency of check-ins	0	.18*	.07	[.03, .32]	.00	.14	.00	.79	[.00, .35]
Usage duration	1	.13*	.03	[.07, .20]	.00	.10*	.00	.82	[.01, .26]
Usage intensity [c]	1	.24*	.07	[.09, .38]	.00	.10	.00	.65	[.11, .36]
World region [a]									
North America	3	.18*	.02	[.14, .22]	.06*	.05	.44	.26	[.08, .28]
Europe	0	.23*	.11	[.01, .44]	.12*	.05	.64	.14	[.06, .40]
Asia	1	.24*	.06	[.12, .36]	.08*	.00	.75	.00	[.14, .34]

Note. k_o = Number of outliers; ρ_o = Pooled, corrected correlation without outliers; SE_o = Standard error of ρ_o; 95% CI = 95% confidence interval of ρ; τ^2_o = Random variance of ρ_o at level 2 and 3; I^2_o = Proportion of total variance in *r* due to random variance (Cheung, 2014); 80% CRI = 80% credibility interval of ρ_o; [a] Based on grandiose narcissism scales; [b] such as uploading photos, commenting, or updating the profile; [c] as measured with the Facebook Intensity Scale (Ellison et al., 2007); [d] Includes only corrections for sampling error but not for measurement error.

* $p < .05$

Supplement H: Publication Bias

PET-PEESE Analyses for Publication Bias

	B_0 (*SE*)	*t*	B_1 (*SE*)	*t*	B_2 (*SE*)	*t*
PET	0.18* (0.02)	8.89	0.18 (0.29)	0.60	-0.22* (0.06)	-3.66
PEESE	**0.18*** (0.02)	10.93	1.15 (2.42)	0.48	-0.22* (0.06)	-3.64

Note. B_0 = Intercept (i.e., the corrected estimate of the overall effect); B_1 = Regression weight for the standard error (PET) or the variance (PEESE) of the individual effect (i.e. the test for funnel plot asymmetry); B_2 = Regression weight for the unreliability (i.e. 1 – coefficient alpha). PET-PEESE estimate of the overall effect corrected for publication bias is in bold.
* $p < .05$

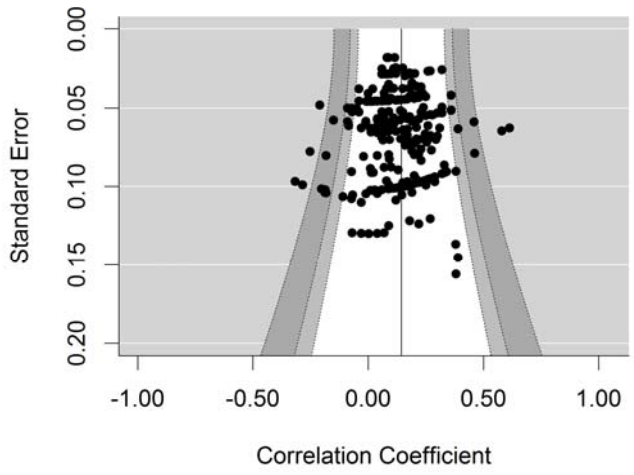

Figure S1. Contour-enhanced funnel plot with 90% (white), 95% (light gray), and 99% (dark gray) confidence intervals around the pooled effect (horizontal line).

The *p*-curve analyses (Simonsohn, Nelson, & Simmons, 2014) determined whether the published findings provide evidence for a true phenomenon or more likely reflect an artifact of publication bias and questionable research practices (QRP) such as *p*-hacking (e.g., excluding participants or selectively reporting variables to achieve significant results). These analyses examine the distribution of the *p*-values between .00 and .05 for the published effects (i.e.

unpublished and non-significant effects are not considered). If these *p*-values are significantly right-skewed, there is positive evidence for the alternative hypothesis (i.e. a true correlation between narcissism and social networking behavior). In contrast, if the null hypothesis holds (i.e. no true correlation) the *p*-values exhibit a uniform distribution. Moreover, a significant left-skew would hint at QRP.

Following Simonsohn and colleagues (2014) the table lists all published studies that identified significant effects and formulated explicit *a priori* predictions regarding the association between narcissism and social networking behavior. Because *p*-curve analyses require independent *p* values, the first effect from each study is reported (cf. Simonsohn et al., 2014). Moreover, the format of the disclosure table slightly differs from the recommendations by Simonsohn and colleagues (2014) because the present meta-analysis did not focus on experimental designs. Moreover, most primary studies reported their results in tables; therefore, they are not readily available form the third column in this table.

The *p*-curve analyses for the selected studies that formulated explicit predictions regarding the association between overt narcissism and social networking behavior indicated significantly right-skewed *p*-values, $Z = -13.63$, $p < .001$ (see blue line in Figure S2). This provides evidence for the examined effect as a true phenomenon and not as a result of intense *p*-hacking.

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P-Curve Disclosure Table

Original paper	**Quoted text from original paper indicating prediction of interest to researchers**	**Quoted text from original paper with results**	**Results**
Barry et al. (2015)	It was hypothesized that the number of selfies posted, the proportion of total posts that were selfies, and the frequency of selfie posts would be positively correlated with dimensions of narcissism.	The proportion of total posts that were classified as selfies […] were unrelated to the dimensions of narcissism.	$r(126) = .10$
Bergman et al. (2011)	Narcissism will be positively related to the reported number of SNS friends.	Narcissism had a significant, positive relationship with the reported […] number of SNS friends.	$r(359) = .24$
Brailovskaia & Bierhoff (2012)	Basierend auf den vorgestellten Befunden und Überlegungen scheint die Annahme begründet zu sein, dass sich sowohl offene als auch verdeckte Narzissten durch eine erhöhte Selbstdarstellung und soziale Interaktion auf der Plattform StudiVZ auszeichnen (Hypothese 3).	Beide Narzissmusformen […] korrelieren signifikant positiv mit der Anzahl insgesamt verwendeter Worte (offener Narzissmus: $r = .19$ […]).	$r(179) = .19$
Buffardi & Campbell (2008)	Consistent with past research on narcissistic self-regulation, narcissism should be associated with (a) a greater amount of social activity (Hypothesis 1) […].	As predicted, higher scores on the NPI were related to higher quantities of interaction on Facebook.	$r(127) = .23$
Carpenter (2012)	Initially, individuals who are high in GE […] are predicted to have a high friend count […].	Also, it was predicted that GE would be associated with a higher friend count […]. GE was again the only substantial predictor of friend count.	$r(292) = .17$
Chen (2014)	The personality traits of extroversion, openness, neuroticism, and narcissism will correlate positively with number of Facebook friends while controlling for gender and Facebook usage.	Number of Facebook friends showed the strongest positive relationship with extroversion (.47, $p < .001$), followed by narcissism (.31, $p < .001$).	$r(207) = .31$
Davenport (2014)	Narcissism will have a stronger positive relationship with Twitter active usage than Facebook active usage.	Results from the regression analyses indicated that narcissism was a significant, positive predictor for frequency of active usage on both Facebook (‘‘FB Status’’) and Twitter (‘‘Tweets’’).	$r(513) = .18$
Fox (2014)	We expect that narcissism (H1) […] will be associated with (a) greater social networking site use.	Trait […] narcissism […] [was] correlated with time spent on social networking sites. Controlling for age, narcissism and trait self-objectification were found to be significant predictors, supporting H1a and H4a.	$r(798) = .19$
Huang (2014)	Adolescents in urban China who are more narcissistic	Results in Table 5.4 show that superiority,	$r(1539) = .11$

Original paper	Quoted text from original paper indicating prediction of interest to researchers	Quoted text from original paper with results	Results
	tend to use social media more.	exploitativeness, and self-absorption significantly and positively correlated with each kind of social media use.	
Lee (2014)	Narcissism will be positively associated with self-presentational information on Wall.	In addition, narcissistic rivalry was positively related to the frequency of updating Status.	$r(234) = .17$
Leung (2013)	Internet users who are more narcissistic will report a higher frequency of content generation using social .media	As shown in Table 3, the narcissistic dimension of exhibitionism significantly correlated with Facebook ($r = .23$, $p < .001$) […] use.	$r(594) = .23$
Mahajan (2013)	Higher scores on […] number of friends, number of status updates, number of photos and amount of time spent on facebook will be associated narcissism and loneliness.	[Not explicitly mentioned in text.]	$r(105) = .08$
Mara (2010)	Je stärker die narzisstische Veranlagung von studiVZ-Usern, desto höher ist die Anzahl ihrer „geaddeten" Freunde.	Zwar ist bei beiden Geschlechtern eine positive Korrelation zwischennarzisstischer Persönlichkeitstendenz und der Anzahl geaddeter studiVZ Freunde erkennbar, allerdings ist dieser Zusammenhang unterschiedlich stark: […] im Fall der männlichen User ein Korrelationskoeffizient in der Höhe von 0,23 (Spearmans Rho; $p < 0{,}001$) festgestellt werden kann […]	$r(285) = .23$
Mehdizadeh (2010)	Individuals with high narcissism scores will be correlated with a greater amount of Facebook activity.	A Pearson correlation addressed the relationship between narcissism and Facebook activity. As predicted, higher scores on the NPI-16 were positively correlated with the number of times Facebook was checked per day, $r = 0.462$, $p < 0.01$.	$r(98) = .462$
Mo & Leung (2014)	The higher subjects score in narcissism, the more they will use Weibo.	Table 5 indicates that intensity of Weibo use was significantly linked to narcissism personality traits ($\beta = 0.14$, $p < 0.01$).	$r(429) = .36$
Ong (2011)	Narcissism will predict a higher frequency of updating Facebook status over and above extraversion.	After controlling for age, grade and gender, the first two hierarchical regression analyses found narcissism to significantly predict […] the frequency of Facebook status updates ($\Delta R^2 = .03$, $\Delta F(1, 247) = 9.08$, $p < .01$, b = .21) over and above extraversion.	$r(273) = .19$
Panek (2013)	Narcissism is positively related to Facebook status	Our hypotheses were supported, as (H1) narcissism	$r(476) = .16$

Original paper	Quoted text from original paper indicating prediction of interest to researchers	Quoted text from original paper with results	Results
	posting frequency.	significantly predicted Facebook status updates, $t(423) = 1.99$, $p < .05$.	
Pettijohn et al. (2012)	As secondary hypotheses, we also predicted positive relationships between […] Facebook use and narcissism	Facebook intensity was not correlated with narcissism, $r(198) = .06$, $p = .32$	$r(198) = .06$
Walters et al. (2015)	We expected that narcissism would predict prospectively time spent on Facebook.	[…] score on the NPI-16 was positively and significantly related to how many times participants reported accessing Facebook since the last survey ($r = .12$, $p = .002$, $N = 600$)	$r(598) = .12$
Weiser et al. (2015)	[…] it was expected that narcissism would be positively related to the frequency of positing selfies on SNSs.	[Not explicitly mentioned in text.]	$r(1,202) = .32$
Winter (2014)	Narcissism is (a) positively related to the number of posted status updates […].	The second step significantly added to the explanation of variance ($F(7,162) = 3.06$, $p = .005$, $R^2 = .117$): Here, narcissism was a significant predictor ($b = .260$, $p = .001$), showing that narcissists particularly made use of the possibility to present themselves via status updates (which supports H2a).	$r(168) = .255$

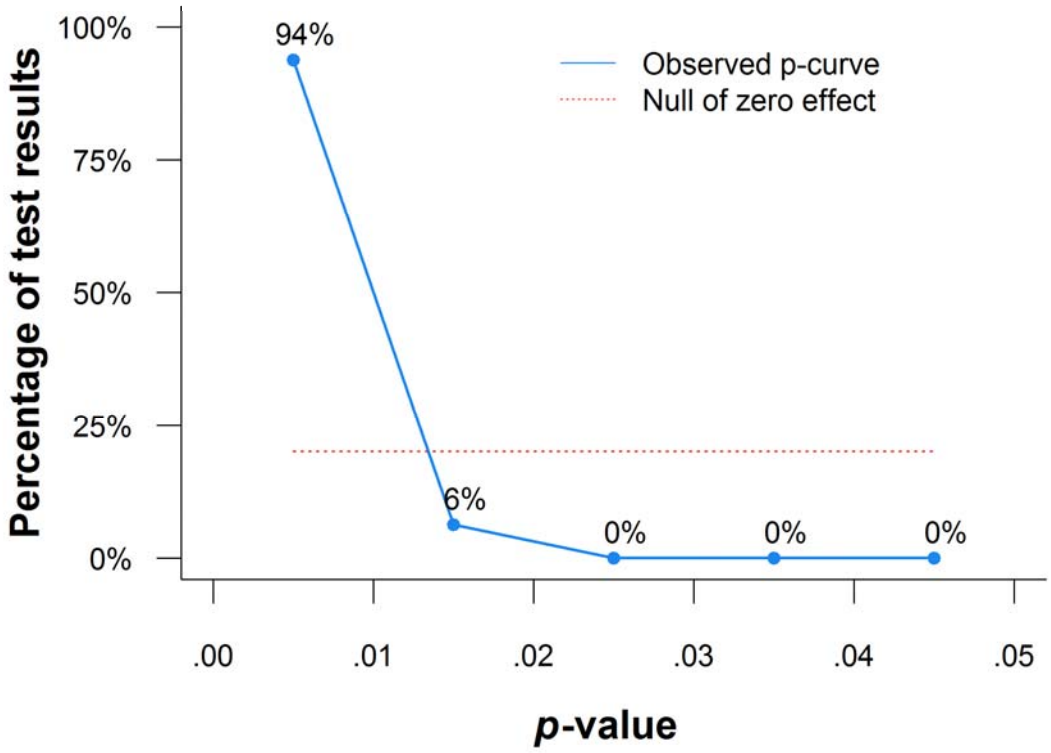

Figure S2. *P*-curve for 18 published studies with significant effects.

Note: Significant right-skew ($p < .001$) indicates that the published research findings reflect evidentiary value for the association between narcissism and social networking behavior, and little evidence for publication bias and intense *p*-hacking.