Title: Adult attachment: Investigating the factor structure of the Relationship Scales Questionnaire

Short title: Relationship Scales Questionnaire

Keywords: adult attachment; close relationships; measurement; relationships; personality

Authors:

Tiago C. Zortea*

Suicidal Behaviour Research Laboratory, Institute of Health and Wellbeing, University of Glasgow, Academic Centre, Gartnavel Royal Hospital, 1055 Great Western Road, Glasgow G12 0XH, Scotland, United Kingdom. Email address: t.carlos-zortea.1@research.gla.ac.uk

*Corresponding author. Telephone number: (44) 0141 201 4469.

ORCID: https://orcid.org/0000-0002-8451-0555

Cindy M. Gray

Institute of Health and Wellbeing, Room 230, 25-29 Bute Gardens, University of Glasgow, Glasgow, G12 8RS, Scotland, United Kingdom. Email address: Cindy.Gray@glasgow.ac.uk

ORCID: https://orcid.org/0000-0002-4295-6110

Rory C. O'Connor

Suicidal Behaviour Research Laboratory, Institute of Health and Wellbeing, University of Glasgow, Academic Centre, Gartnavel Royal Hospital, 1055 Great Western Road, Glasgow G12 0XH, Scotland, United Kingdom. Email address: Rory.OConnor@glasgow.ac.uk

ORCID: https://orcid.org/0000-0002-3650-4994

Abstract

Objective: In this study we aimed to conduct an in-depth psychometric investigation of the Relationships Scales Questionnaire (RSQ).

Method: 717 UK-based participants responded to an online questionnaire (F = 540, M = 177; age range 18-66 years, *M* = 25, *SD* = 8.46). We conducted (1) a series of confirmatory factor analyses (CFA) to test previous published factor models of the RSQ, (2) traditional (Exploratory Factor Analysis, Confirmatory Factor Analysis) and contemporary (Exploratory Graph Analysis) exploratory techniques, followed by (3) validity and reliability analyses.

Results: Although the RSQ was developed to assess four categories of adult attachment (typological approach – i.e., secure, preoccupied, dismissing, fearful), our findings do not support the hypothesis that the RSQ delivers a psychometrically consistent measure of adult attachment styles.

Conclusion: The results of the present study suggest that a two-dimensional approach (i.e., anxiety and avoidance) to assessing adult attachment is optimal.

Keywords: adult attachment; close relationships; measurement; relationships; personality

Adult attachment: Investigating the factor structure of the Relationship Scales Questionnaire

Attachment theory is a comprehensive framework which endeavors to understand how emotional bonds and relationships develop (Ainsworth & Bowlby, 1991; Ainsworth, 1964; Bretherton, 1992). Attachment relationships are shaped throughout the lifespan, beginning with how parents/guardians care for, treat and raise their child (Lopez, 1995; Marvin & Britner, 1999). They are thought to be relatively stable across time, with longitudinal research highlighting the continuity of attachment patterns from childhood into adulthood for close relationships (Maunder & Hunter, 2012; Waters, Merrick, Treboux, Crowell, & Albersheim, 2000). In seminal research, Ainsworth and colleagues (1964) identified three patterns of attachment with significant others: secure, anxious and avoidant. Subsequently, Hazan and Shaver (1987) and Shaver, Hazan, and Bradshaw (1988) proposed that adults also exhibit three major styles of attachment: secure, avoidant and anxious-ambivalent, whereas Bartholomew and Horowitz (1991) suggested four attachment patterns: secure, preoccupied, fearful, and dismissing.

Aside from the debate about which constructs best capture adult attachment (Bartholomew & Shaver, 1998; Fraley, Waller, & Brennan, 2000; Hazan & Shaver, 1994; Ravitz, Maunder, Hunter, Sthankiya, & Lancee, 2010; Stein et al., 2002), recent attention has focused on whether adult attachment should be measured via a typological approach – by assessing someone's styles/patterns of attachment, or in a dimensional way – by evaluating internal working models through levels of attachment avoidance and anxiety (Hazan & Shaver, 1994; Stein et al., 2002; Fraley, Hudson, Heffernan, & Segal, 2015).

Brennan, Clark, and Shaver (1998) argue that even though Ainsworth et al. (1978) classified attachment into three main patterns, their classifications could in fact be conceptualized by two dimensions. Namely, the dimensions of avoidance (e.g. discomfort with intimacy and dependency, avoiding emotional connection) and anxiety (e.g. crying, difficulty in exploring the environment confidently without the mother, and expressing anger towards the mother in reunions after an experience of abandonment). Indeed, Fraley and Waller (1998), Fraley et al. (2015) and Stein et al. (2002) provided evidence supporting the hypothesis that adult attachment would be better assessed through dimensional models rather than categorically.

Several studies have compared adult attachment measures psychometrically, conceptually, and methodologically (e.g., Bartholomew & Shaver, 1998; Fraley & Waller, 1998; Fraley & Bonanno, 2004; Fraley et al., 2000; Fraley et al., 2015; Ravitz et al., 2010; Roisman et al., 2007; Stein et al., 2002). However, although the use of dimensional models has been increasingly employed, typological models and methods are still largely used to guide much of the work within attachment theory research (e.g., Barnes & Caltabiano, 2017; Liu et al., 2018; Molaie et al., 2019; Yaseen, Galynker, Cohen, & Briggs, 2017). Fraley and colleagues (2015) suggest that the categorical versus dimensional question has not been fully resolved, which reflects the lack of consensus among researchers regarding whether the phenomenon of adult attachment is intrinsically typological or dimensional (Ravitz et al., 2010). Inconsistencies such as these consequently limit understanding of adult attachment itself. Fraley et al. (2015) stated that there is clearly a need for a more conclusive examination of the dimensional versus categorical nature of adult attachment.

The persistent use of categorical models in adult attachment theory research suggests a series of issues (Fraley & Waller, 1998), and the implications go beyond research. Ravitz and colleagues (2010) have suggested that categories can be helpful in aiding clinicians to tailor interventions thereby facilitating rapid diagnosis and clinical decision-making. However, recent evidence does not support such a rationale (Fraley et al., 2015), indicating that categorization (even when using attachment rating scales to categorize people) may misrepresent the nature of individual differences in an individual's attachment repertoire, potentially misguiding tailored clinical interventions. For example, through the four-category model of adult attachment (i.e. secure, preoccupied, dismissing, fearful) proposed by Griffin and Bartholomew (1994a) clinicians would be inclined to formulate their patients' cases by attributing to them one of the four prototypes. In theory, each of these attachment styles would be characterized by different psychological mechanisms. However, research has shown that these typologies are not mutually independent or distinctive from each other, and individuals often present attachment-related characteristics that fall into 'opposite' categories (Fraley et al., 1998; 2015).

Although some studies suggest the convergence of different measures of adult attachment (Bartholomew & Shaver, 1998; Sperling, Foelsch, & Grace, 1996; Stein et al., 2002), a number of questions remain regarding which questionnaire should be used to assess which models of adult attachment (dimensional or categorical). The Relationship Scales Questionnaire (RSQ) was proposed by Griffin and Bartholomew (1994a) and is considered to be a combined measure of adult attachment, including theoretical schemes proposed by a range of authors (Roisman et al., 2007). Griffin and Bartholomew (1994b) suggested that the instrument is appropriate to measure adult attachment through four style categories (Bartholomew & Horowitz, 1991) or also dimensionally by assessing internal working models (anxious vs avoidant) (Griffin & Bartholomew, 1994b), implying that the two dimensions of adult attachment underlie the four attachment styles. The four-category model assessed by the RSQ often fails to deliver adequate psychometric properties (e.g., Andersen, Pedersen, Carlsen, Olesen, & Vedsted, 2017; Bäckström & Holmes, 2001; Brussoni, Jang, Livesley, & Macbeth, 2000; Cicero, Lo Coco, Gullo, & Lo

Verso, 2009; Ciechanowski, Sullivan, Jensen, Romano, & Summers, 2003; Guédeney, Fermanian, & Bifulco, 2009; Reis & Grenyer, 2002; Siegert, Ward, & Hudson, 1995; Steffanowski et al., 2001) and there is no consensus on its factor structure (Andersen et al., 2017; Kurdek, 2002; Roisman et al., 2007). Regardless of these issues, the RSQ is still widely used to assess attachment typologically, despite the existence of other self-report scales to measure adult attachment dimensionally (Fraley & Bonanno, 2004; Fraley et al., 2015; Mikulincer & Shaver, 2016; Ravitz et al., 2010).

Several recent studies employing the RSQ either have not reported the scale's psychometric properties (e.g. Li et al., 2017; Massey, Compton, & Kaslow, 2014; Molaie et al., 2019; Pennel, Quesada, & Dematteis, 2018; Yaseen, Galynker, Cohen, & Briggs, 2017) or have reported questionable reliability indices (e.g., Brown et al., 2013; Ilhan, 2012; Barnes & Caltabiano, 2017; Otani et al., 2016). Additionally, it is difficult to know whether the presence or absence of the associations between attachment styles and other psychological outcomes reported in those studies represent an indication of a true effect or whether the findings are due to measurement error. For example, in Constantino et al.'s (2013) study, it is difficult to know whether fearful avoidant was the best attachment style (out of four styles) to predict their research outcome variable. Does this represent a true predictive effect, or did this relationship emerge as significant only because fearful avoidant attachment was the most reliable among the four attachment categories? Such reliability problems are still common in the use of the RSQ, highlighting the importance of further psychometric investigations (Fraley et al., 2015).

Finally, although some studies have tested different factor models of the RSQ (Andersen et al., 2017; Bäckström & Holmes, 2001; Scharfe & Bartholomew, 1994; Siegert et al., 1995; Stein et al., 2002; Kurdek, 2002; Roisman et al., 2007), no study has exclusively investigated the factor structure of the scale through different methodological approaches. As a result, in this current study we aimed to address this important gap within the literature:

1) Replicate the confirmatory factor analyses carried out by Roisman et al. (2007) which tested seven different factorial models of the RSQ scale from previous studies;
2) Conduct an exploratory factor analysis (EFA) to uncover the underlying structure of the RSQ items;
3) Conduct a confirmatory factor analysis (CFA) to test the validity of the factor solution generated by the EFA;
4) Conduct an exploratory graph analysis (EGA) using network analysis techniques;
5) Conduct a CFA to test the validation of the structure solution generated by the EGA;
6) Compare the outcomes of the CFAs of the replication models, EFA model and the EGA model.

Method

Participants

717 UK based participants responded to an online questionnaire. The data used in the current study were collected as part of the family, relationships, stress and wellbeing project, which included other measures of perceived parenting, stress, depressive symptoms, and suicidal ideation. The study was advertised on social media platforms (e.g., Twitter, Facebook), and those who took part were entered into a prize draw to win an iPad Mini or a £200 high street shopping voucher. The overall time of participation varied between 15 and 20 minutes.

Ethical approval was granted by the College of Medical, Veterinary, and Life Sciences of the University of Glasgow research ethics committee (Application No. 200150063). Female participants comprised the majority of the sample (n = 540; 76.1%; seven participants (1%) did not report gender), who were aged between 18 and 66 years (*M* = 25 years old, *SD* = 8.46). Participants were predominantly white (*n* = 598; 84.3%) and heterosexual (*n* = 586; 81.8%). Although relationship status is an important factor that may have some impact on participants' responses to the attachment measure, this variable was only available through the following categories: never married (*n* = 615, 86%), married (*n* = 67, 9.2%), separated (*n* = 4, 0.5%), divorced (*n* = 8, 1.1%), widowed (*n* = 3, 0.4%), and partnership (*n* = 17, 2.3%).

In order to carry out the analysis plan, the sample was split randomly into two subsamples (exploratory subsample: *n* = 358; confirmatory subsample: *n* = 359). Both subsamples had characteristics that were similar to the total sample: the exploratory subsample was mostly comprised of females (*n* = 272; 76%), who were aged between 18 and 66 years (*M* = 25 years old, *SD* = 8.63), predominantly white (*n* = 298; 84.4%), never married (*n* = 309, 86.8%), and heterosexual (*n* = 293; 81.8%). Likewise, confirmatory subsample participants were also mostly female (*n* = 268, 75.5%), white (*n* = 300, 84.3%), never married (*n* = 306, 85.2%), and heterosexual (*n* = 293; 81.8%).

Missing data treatment

There were minimal missing data (0.21% missing data) across the complete dataset. The choice of the most suitable missing data treatment method depends on the mechanism of the missing data pattern, that is, whether the observed values in the data are associated with those data that are missing and hence able to explain the pattern of missingness (Haukoos & Newgard, 2007). These mechanisms can be missing completely at random (MCAR – when the probability that a value is missing is independent of all other variables, observed and unobserved); missing at random (MAR – when the pattern of missing data depends on observed values in the sample but does not depend on any unobserved values); and missing not at random (MNAR – when the pattern of missing data is related to variables that were not collected and are not associated with observed variables) (Donders, van der Heijden, Stijnen, & Moons, 2006; Haukoos & Newgard, 2007; Little & Rubin, 2002). In the current study, Little's MCAR analysis suggested that the missing data pattern was not completely at random ($X^2 = 692.646$, $df = 566$, $p < .001$); however, inspection of the missing values pattern plots indicated that the missing values were missing at random. As a result, multiple imputation was applied to account for the missing data (Newgard & Haukoos, 2007; Sterne et al., 2009).

Analysis plan

To replicate Roisman et al.'s (2007) series of CFAs (objective 1), we used the complete dataset (*N* = 717). To achieve objectives 1-5, we randomly split the complete dataset into two subsamples for exploratory and confirmatory analytical purposes: we conducted the EFA and the EGA in the exploratory subsample and subsequently conducted the CFAs of the solutions emerged from the EFA and the EGA in the confirmatory subsample. To accomplish objective 6, we constructed an aggregated plot to assist the comparative analysis of all CFA models' indexes. Figure 1 summarizes the analytical strategy employed.

[Insert Figure 1 here]

Data analysis

Replication of previous factorial models and Confirmatory Factor Analysis (CFA).

We first endeavored to replicate the CFA carried out by Roisman et al. (2007) wherein they tested seven different factorial models of the RSQ scale based on previous research. Model 1 (Collins, 1996) specified a 3-factor solution (dependence, anxiety, and closeness) as did Model 2 (Hazan & Shaver, 1987): secure, avoidant, and anxious-ambivalent. Models 3 to 6 (Creasey & Ladd, 2005; Feeney & Hohaus, 2001; Fraley & Bonanno, 2004; Simpson, Rholes, & Nelligan,

1992) tested a 2-factor solution with different items loading onto anxiety and avoidance attachment factors, and finally Model 7, the original model from Griffin and Bartholomew (1994a) tested the 4-factor structure: secure, fearful, preoccupied, and dismissing (details of factor structures are available in the Supplemental Materials, Table A).

Although Roisman et al. (2007) did not report the method used to estimate parameters in their CFA models, in the current study we conducted all CFAs using a weighted least square mean and variance (WLSMV) estimator, which has been suggested to be more appropriate for ordinal data (Li, 2016). All models of the replication section of this study were tested with the complete dataset (Figure 1). Analyses were conducted in R version 3.5.0 using LAVAAN package for R (Rosseel, 2012). Replicating this series of CFAs is essential to test the fit of the factorial models tested by Roisman et al. (2007), as well as to compare the factorial structures that emerged from the exploratory methods (EFA and EGA). By conducting a CFA, it is possible to test whether the proposed models within the RSQ are consistent with the typological and dimensional views of adult attachment.

Exploratory Factor Analysis (EFA).

To be consistent with the previous studies on the investigation of the underlying structure of the RSQ (e.g., Andersen et al., 2017; Bäckström & Holmes, 2001; Scharfe & Bartholomew, 1994; Siegert et al., 1995; Stein et al., 2002; Kurdek, 2002; Roisman et al., 2007), we have conducted an EFA to establish the factorial structure of the scale. The use of EFA is important in the context of the current study as we aimed to compare its performance with the EGA (aim 6) both psychometrically and theoretically.

To evaluate the strength of associations between item loadings and respective factors, Comrey and Lee (1992) suggested the following thresholds: 0.32 poor, 0.45 fair, 0.55 good, 0.63

very good and 0.71 excellent. In the present study, an EFA was conducted with the exploratory subsample (Figure 1). Following Costello and Osborne (2005) guidelines for best practice for EFA, the maximum-likelihood method with oblique rotation (direct oblimin) was used, as it allows factors to be related. A Parallel Analysis (PA; Eigenvalue Monte Carlo Simulation) was conducted to confirm the factor retention. This analysis is recommended to establish factor retention (Courtney, 2013; O'Connor, 2000). The procedure was conducted using the syntax made available by O'Connor (2000) at https://people.ok.ubc.ca/brioconn/nfactors/nfactors.html. PA involves the development of correlation matrices of random variables based on the same sample size and number of variables in the real dataset. The mean eigenvalues generated from those matrices are then compared to the eigenvalues from the actual dataset correlation matrix. The factors that should be retained are those corresponding to the real eigenvalues whose values are greater than the 95th percentile Monte Carlo simulated eigenvalues generated by the correlation matrices. Therefore, those retained factors presented statistically significant eigenvalues at the level of .05. Both EFA and PA were conducted in IBM SPSS version 24.

Exploratory Graph Analysis (EGA).

Exploratory Graph Analysis is an innovative approach designed to uncover clusters in sparse networks. This method belongs to a larger contemporary research field called network analysis (e.g., Borsboom & Cramer, 2013) whose emphasis lies on the estimation of undirected network models to psychological datasets (Golino & Epskamp, 2017). Through this analytical method, items are represented in the network as nodes and the relationship between them by edges. It is argued that when analyzing network connections, the clusters formed by nodes within the network may emerge due to the existence of underlying latent constructs. As described by Golino and Epskamp (2017), this process works through the estimation of a Gaussian graphical lasso with the regularization parameter specified using EBIC. The number of underlying clusters is established through an algorithm called *walktrap* that identifies communities of nodes in the network by the similarities between vertices (i.e. nodes where two or more edges meet) and the distance between nodes (i.e., the closer are the nodes, the more likely is that they belong to the same cluster). For an in-depth explanation, we refer to Golino and Demetriou (2017), and Pons and Latapy (2006).

Golino and Demetriou (2017) argue that EGA outperforms traditional techniques such as parallel analysis (PA) and the minimum average partial procedure (MAP), which are commonly employed to determine the number of dimensions to be retained in an EFA. These conventional procedures tend to underestimate the number of factors in realistic data in comparison to simulated data, particularly when the (1) correlation between latent variables is high (.70),(2) the number of items loaded per factor is low (Keith, Caemmerer, & Reynolds, 2016), and (3) when the sample size is relatively small ($N < 500$) (Golino & Epskamp, 2017; Ruscio & Roche, 2012). Considering that the EGA has been effective in overcoming these issues (Golino & Demetriou, 2017; Golino & Epskamp, 2017), and given the inconsistencies in the factor structures of the RSQ (Roisman et al., 2007), the employment of the EGA in the current study increases the likelihood of the emergence of a more accurate factorial structure.

One of the objectives (6) of the current study is to compare the accuracy of the factorial models generated by the EGA and the traditional EFA (through a series of CFAs) in our data. Although research shows the superiority of EGA over EFA when the three conditions mentioned above are met (Golino & Demetriou, 2017; Golino & Epskamp, 2017), it is difficult to provide the prior information about those conditions for the RSQ (i.e. the correlation level between the RSQ latent variables, and the number of items loading per factor). This difficulty exists due to the following reasons: (1) Roisman et al. (2007) – our reference study for replicability – does not report those values for the models tested, rendering it hard to obtain an approximate estimate of the RSQ intercorrelation factorial properties; and (2) Different models are tested by Roisman et al. (2007), meaning that each of their factorial structures will yield different intercorrelation levels between factors, and a different number of items loading per factor. However, the reduction of the data into two subsamples ($N < 500$) in the current study benefits from using EGA, increasing the likelihood of obtaining a more accurate factor structure of the RSQ.

Following the same procedures employed by Forkmann, Teismann, Stenzel, Glaesmer, and De Beurs (2018), we conducted an EGA re-estimating the number of dimensions of 1000 bootstraps from the exploratory subsample using a parametric approach to obtain a more stable solution. Subsequently, we conducted a CFA to test the fit of the solution proposed by the EGA (Figure 1). The EGA was performed in R using the coding made available by Forkmann et al. (2018) at https://derekdebeurs.shinyapps.io/Online_code/#section-introduction.

Validity and Reliability.

Discriminant validity determines whether the factors of the scale represent distinct constructs, as demonstrated through the calculation of the Heterotrait-monotrait (HTMT) ratio of correlations between factors. Although the exact cut-off level of the HTMT is debatable, it is generally suggested that if the HTMT value is higher than 0.85, it is possible to conclude that there is a lack of discriminant validity (Harrington, 2009; Henseler, Ringle, & Sarstedt, 2014). Reliability determines whether the observable variables of a scale (i.e., its items) that suggest measuring the same construct (factor or subscale) produce similar scores, establishing an internal consistency of that particular construct. On the assessment of reliability, Cronbach's alpha (α) and Omega (ω) indices are provided. Thresholds for these indices are traditionally suggested as:

α/ω ≥ 0.9 excellent, 0.9 > α/ω ≥ 0.8 good, 0.8 > α/ω ≥ 0.7 acceptable, 0.7 > α/ω ≥ 0.6 questionable, 0.6 > α/ω ≥ 0.5 poor, and 0.5 > α/ω unacceptable. Analyses of validity and reliability were conducted only for models that demonstrated acceptable CFA indices.

Conducting validity and reliability analyses constitutes one of the most crucial steps when evaluating a psychological measure, and these tests designate the accuracy of each emerged factor, indicating the extent to which one can trust the scale. This is critical for the evaluation of the RSQ due to the previously reported factorial inconsistencies (Kurdek, 2002; Roisman et al., 2007).

Results

Replication of Roisman et al.'s (2007) series of CFAs

The outcomes of CFAs of the seven models specified above are presented in Table 1, columns 'Replication models' (Models 1-7). To be consistent with Roisman et al. (2007), we applied Hu and Bentler's (1998, 1999) criteria for interpreting fit indices: Chi-square/df (*CMIN/DF*) should be ≤ 2 or 3, although this index has been found to be too sensitive in sample sizes that exceed 250 (Bentler & Bonett, 1980); comparative fit index (*CFI*) with values > .95 considered great, >.90 traditional, and >.80 permissible; goodness of fit index (*GFI*) ≥ .95; adjusted goodness of fit index (*AGFI*) > .80; standardized root mean square residual (*SRMR*) ≤ .09; root mean square error of approximation (*RMSEA*) < .05 considered good, .05–.10 moderate, and > .10 inadequate; and p-value for close fit (*PCLOSE*) > .05.

[Insert Table 1 here]

Although several fit indices are used to determine the psychometric appropriateness of a model in a CFA (Hu & Bentler, 1999), Roisman and colleagues (2007) only reported the CFI and the SRMR metrics. Thus, we cannot compare their other five CFA indexes with those obtained in the current study (Table 1). In their series of CFAs, Roisman et al. (2007) found that only Model 3 proposed by Simpson et al. (1992), which assessed the constructs of anxiety and avoidance attachment styles, yielded a marginally acceptable fit to their data (CFI = .96 and SRMR = .06). Therefore, when comparing the CFI and SRMR indices of our CFAs with those obtained by Roisman et al. (2007), Simpson et al.'s (1992) 2-factor model also yielded the best fit to our data (Table 1, Model 3), followed by Collins's (1996) 3-factor model assessing dependence, anxiety, and closeness (Table 1, Model 1), both models achieving the minimum cut-off criteria for CFI and SRMR. However, when comparing Models 1 and 3 including the other CFA indexes in our replication analysis, Simpson et al.'s (1992) factor structure is a better fit to our data.

Regarding internal consistency for Simpson et al.'s (1992) model, Roisman et al. (2007) reported Cronbach's alpha values of α = .85 and α = .81, for avoidance and anxiety, respectively which were both considered to indicate good reliability. Although Simpson et al.'s (1992) solution also yielded the best fit to our data, this was not confirmed in the factor reliability analysis: we found good reliability for the subscale of anxiety α = .80, but not for avoidance subscale, where α = .39. Collins's (1996) model (Model 1) also yielded unacceptable alpha values for dependence (.38) and closeness (37), but an acceptable value for anxiety (.77). Other information on validity and reliability for both Models 1 and 3 for our data are presented in Table 3.

Exploratory Factor Analysis

Chi-square and t-tests were conducted to compare the exploratory and confirmatory subsamples. Chi-square tests showed no significant differences for categorical demographic variables between the subsamples (Table B, Supplemental Materials). The t-tests also revealed no differences between the subsamples for age and item response (Table C, Supplemental Materials).

The suitability of EFA was assessed before the analysis. Inspection of the correlation matrix showed that all variables had at least one correlation coefficient greater than 0.3. The overall Kaiser-Meyer-Olkin (KMO) measure was 0.87, with individual KMO measures all greater than 0.7; classifications of ‘middling’ to ‘meritorious’ according to Kaiser (1974). Bartlett's Test of Sphericity was statistically significant ($p < .0005$), indicating that the data were likely factorable. EFA revealed seven factors that had eigenvalues greater than one and which, together, explained 64% of the total variance. Visual inspection of the scree plot (Figure A, Supplemental Materials) also indicated that seven factors should be retained base on eigenvalues > 1 (Cattell, 1966).

When comparing the EFA solution with the PA outcome, conflicting solutions were obtained: PA suggested the retention of 10 factors in contrast with EFA (seven). Table D (Supplemental Materials) shows the number of possible factors (*Root*), the eigenvalues from the data through EFA (*Raw data*), the eigenvalues associated with the Monte Carlo Simulation – the 50^{th} percentile or the median (*Means*), and the 95^{th} percentile (*Prcntyle*).

Regarding the conflicting findings between the PA and EFA, we adopted the EFA model, as it showed a more consistent distribution of items across a more concise number of factors. However, the decision about the number of factors to be retained was also influenced by the criterion of minimum number of items per factor. Although there is some debate on this issue, “it is thus recommended that absolutely no fewer than three items per factor be adhered to throughout” (Raubenheimer, 2004) as this may affect the psychometric properties of the instrument, consequently leading to potential bias of measurement error. As the EFA yielded a first factor (Table 2) with only two items (15 and 22), we decided to exclude it from the final model. Item 18 was also not included as its factor loadings did not achieve the minimum threshold (0.3). Thus, in the final solution six factors were retained (2-7 in Table 2).

The factors which resulted from the current EFA were named based on similarities to factors identified in previous psychometric studies of the RSQ. Specifically, we adopted Andersen et al.'s (2017) labelling for the first three factors of our EFA solution: "Relationship worry" (Factor 2: items 11, 12, 21, 23), "Closeness" (Factor 3: items 3, 4, 30), and "Independence" (Factor 4: items 1, 2, 19, 26). The factor labels "Lack of trust" (Factor 5: items 5, 7, -10, 16, 17, -27) and "Fear of Separation" (Factor 7: items 8, 9, 14, 25, 28) were adopted from Steffanowski et al. (2001). Finally, "Avoidance" (Factor 6: items 6, 13, 20, 24, 29) was named following the similarity with Simpson et al.'s (1992) classification.

An inspection of the item loadings across factors revealed five items (i.e., pattern matrix coefficients over 0.3) which cross-loaded on more than one factor. Item 5 ('I worry that I will be hurt if I allow myself to become too close to others') and item 12 ('I find it difficult to trust others completely') loaded on factors 2 and 5; item 10 ('I am comfortable depending on other people') loaded on factors 4 and 5; item 16 ('I worry that others don't value me as much as I value them') loaded on both factor 5 and 7; and item 23 ('I worry about being abandoned') loaded on factors 2 and 7. Since these were the only unsettled items, they were kept in the analysis on the factors they had loaded most on as indicated by an asterisk (*) in Table 2. Some items (4, 5, 6, 23, 25) had lower loadings (between 0.34–0.38 level), but they were not regarded as unsettled since these items were distributed across the scale rather than grouped on a single factor.

Confirmatory Factor Analysis of the EFA 6-factor solution (Model 8)

A CFA was conducted with the confirmatory subsample (Figure 1) to test the 6-factor model extracted from the EFA conducted with the exploratory subsample (Model 8). The CFA showed that the EFA model did not yield adequate indices of fit (see Table 1, Model 8).

Exploratory Graph Analysis (Network Analysis)

The bootstrapped EGA of the exploratory sample identified six dimensions. Figure 2 shows the network analysis demonstrating how the RSQ items are connected for the exploratory subsample. A node's colors indicate clustering as identified by the *walktrap* algorithm and the edge colors connecting the items show the direction of the association between items (green as positive, orange as negative). We named the network clusters following the same criterion adopted to label the factors extracted from the EFA previously mentioned. Although the EFA identified items 1, 2, 19 and 26 as belonging to the same factor, the EGA clustered items 2 and 19 as an independent dimension. Following Raubenheimer's (2004) recommendations on the minimum number of items to be retained per factor, we did not include the 'independence' dimension in the further CFA to test the network model. Thus, the EGA yielded a 5-dimension model (Figure 2).

[Insert Figure 2 here]

Confirmatory Factor Analysis of the EGA 5-dimension solution (Model 9)

A CFA was conducted with the confirmatory subsample (Figure 1) to test the 5-dimension solution obtained from the network analysis conducted with the exploratory subsample. The CFA revealed that the structure solution generated by the EGA yielded acceptable indices of fit (see Table 1, Model 9).

Comparison of CFAs models, Validity and Reliability analysis, and the post-hoc development of Model 10

To assist the comparative analysis of the differences across the nine different models of the RSQ, we constructed an aggregated plot (Figure 3) with the main CFA indices of fit (CMIN/DF, CFI, GFI, AGFI, SRMR, and RMSEA). The models' CFAs overall p-value, as well as the PCLOSE, were not included in the aggregated plot as they did not vary across models, except for Model 3 (Simpson et al., 1992) which was the only model that showed a PCLOSE = 0.017.

[Insert Figure 3 here]

Although obtaining adequate fit from a CFA is an important stage in the process of testing a factor structure, this does not imply that the model is valid and reliable for measuring the psychological constructs that it was created for. Analyzing the psychometric properties of the scale is a fundamental step in establishing the accuracy of a psychological measure. Thus, analyses of validity and reliability were conducted for those models that yielded an acceptable CFA fit (Models 1, 3, 8 and 9 – Figure 3). Cronbach's alpha and omega indices (with standard errors and 95% confidence intervals) were calculated to assess reliability, and the Heterotrait-monotrait (HTMT) ratio of correlations between the factors of each model was computed to evaluate discriminant validity (Table 3).

[Insert Table 3 here]

In comparison with previous studies that used models 1 and 3, the internal consistency estimates presented in Table 3 were poorer. For model 1, Collins (1996) reported .77, .78, and .85 Cronbach's alpha for the closeness, dependence, and anxiety factors, respectively. For model 3, the estimates tested in our data were also poorer when compared to previous studies.

Roisman et al. (2007) reported .85 and .81 for avoidance and anxiety, respectively; whereas Kurdek (2002) obtained .77 for the former and .83 for the latter.

As none of the models demonstrated good or excellent reliability for all their respective factors, and given that the literature on adult attachment also supports the advantages of a dimensional over a categorical approach on assessing attachment (Brennan et al., 1998; Hazan & Shaver, 1994; Kobak, Cole, Ferenz-Gillies, Fleming, & Gamble, 1993; Stein et al., 2002), we developed a post-hoc dimensional model with the combination of the dimensions of anxiety and avoidance from the EGA and the EFA models, respectively. The selection of these dimensions was based on their performance of good reliability and validity (Table 3) and on their theoretical consistency with the items corresponding to the respective dimensions from previous models (1-7). As the "Relationship Worry" factor from Model 8 (EFA) and the "Anxiety" factor from Model 9 (EGA) had overlapping items, the latter factor was chosen due to its higher validity and reliability indices.

We then submitted the model to a CFA that yielded acceptable fit indices (Model 10, Figure 3, Table 3). Therefore, Model 10 comprised the following 2-factor structure: anxiety (items 9, 11, 16, 21, 23, 25, 28) and avoidance (items 6, 13, 20, 24, 29). This 2-dimensional combined model presented the best CFA fit, validity and reliability indices when compared with the seven replicated models, the EFA solution, and the network analysis structure.

Discussion

In the present study, we attempted to investigate the factor structure of the Relationships Scales Questionnaire (RSQ) through a psychometric replication of previous models using traditional (EFA) and contemporary (EGA) exploratory techniques. From the seven models re-tested in the replication of CFAs, the original 4-category factorial structure proposed for the RSQ (secure, preoccupied, dismissing, and fearful, by Griffin & Bartholomew, 1994a) performed badly in terms of CFA indices (particularly CMIN/DF, CFI, and RMSEA). This is consistent with previous research on the appropriateness of the RSQ to assess the four-category model of adult attachment (Fraley & Waller, 1998; Siegert et al., 1995). According to Andersen et al. (2017), no CFA of the RSQ has been able to replicate the four attachment subscales proposed by Bartholomew and Horowitz (1991).

Models 1 (Collins, 1996) and 3 (Simpson et al., 1992) yielded the best fit indices compared to the other models, which is consistent with previous research (Kurdek, 2002; Roisman et al., 2007). However, these two models did not perform adequately in the internal consistency analyses. Only the factors related to anxiety exhibited good validity and reliability for both models. Therefore, although two of the seven models derived from Roisman et al. (2007) were a good fit for our data, none of them demonstrated good internal consistency.

To our knowledge, this is the first study to employ EGA to investigate the factor structure of a self-report measure of adult attachment. Indeed, one of the aims of the current study was to compare its performance with the traditional exploratory method, namely EFA. These exploratory analyses (EFA and EGA) yielded slightly different results. When comparing the CFAs indices for the models (Figure 3), it is clear that the EGA (Model 9) performed better in clustering the RSQ items than the traditional EFA (Model 8). However, the EFA model had more factors with acceptable internal consistency (four out of six) than the EGA model (two out of five). Although attachment style constructs (e.g., secure, preoccupied, dismissing, fearful) and internal working models (self/anxiety and others/avoidance) are defined by specific beliefs and attitudes towards close relationships (represented through items in the RSQ), the exploratory analyses (EFA and EGA) in the current study clustered these psychological aspects into categories/factors that are inconsistent with the theory. For example: attachment avoidance theoretically includes difficulty with trusting people, a more independent approach to relationships, and avoiding intimacy; these three characteristics (avoidance, lack of trust and independence) were clustered in separate groups by the EFA and the EGA (e.g., avoidance and lack of trust). These findings raise critical concerns previously discussed in the literature on adult attachment, for example, what are the scales actually assessing? Stein et al. (2002) suggest that it is difficult to pinpoint whether instruments such as the RSQ are measuring adult attachment behaviors, wishes and expectations about establishing close relationships, a trait existing across most relationships or a state of mind that is at least partially relationship-specific.

Although the RSQ's aim is assessing four different types of attachment profiles and their related feelings, thoughts, and behaviors, our findings do not support such aim. Fraley and Waller (1998) suggest that this problem arises because researchers are conceptualizing adult attachment as a categorical phenomenon in which individuals are classified according to their attachment patterns, rather than understanding it as dimensional (i.e. a manifestations of internal working models). Therefore, it is possible that the RSQ was constructed under the assumption that adult attachment is a categorical phenomenon, when 'in reality' the psychological components of these categories seem to be scattered across anxiety and avoidance (Fraley et al., 2000; Fraley, Heffernan, Vicary, & Brumbaugh, 2011; Fraley et al., 2015). Based on this, we conducted a post-hoc CFA of a two-dimensional model, that comprised avoidance and anxiety factors from both the EFA and the EGA, respectively (see Model 10, Table 1, Figure 3). Although this model performed best in comparison with the replicated and the novel exploratory analyses models, it is unknown whether this combined Model 10 is robust. Therefore, future research should endeavor to replicate the present findings.

In the context of adult attachment psychometrics research, our findings corroborate the theoretical perspective that adult attachment is better operationalized through variations in the dimensions of anxiety and avoidance (Fraley et al., 2015; Roisman et al., 2007). As highlighted in previous studies focused on self-report instruments of adult attachment (e.g., Fraley et al., 2015; Mikulincer & Shaver, 2016; Ravitz et al., 2010), categorical questionnaires are criticized theoretically for considering the differences among individuals within a single category as irrelevant or non-existent (Mikulincer & Shaver, 2016). From an analytic point of view, categorical measures also present limited statistical power and psychometric properties when compared to dimensional scales (Fraley & Shaver, 2000; Ravitz et al., 2010). Taxometric analyses have demonstrated that individual differences in adult attachment are continuously distributed not only at the general level of attachment representations but also in the context of specific relationships (e.g., attachment with partners, friends, parents) (Fraley & Waller, 1998; Fraley et al., 2015).

The current study provides some interrelated implications for theory, research, and practice. Our findings provide evidence for the assumption that the use of typological models may be misleading. When conducting research into adult attachment relationships that use self-reported measures, researchers should consider employing scales that were developed based on a dimensional (see Ravitz et al., 2010 for an extensive review on adult attachment measures) rather than typological approach. The post-hoc factorial model proposed in the current study (Model 10) may help researchers to analyze existing datasets which employed the RSQ, conveying more reliable estimates of attachment dimensions. Fraley et al. (2015) suggest that conceptualizing individual differences in adult attachment in typological terms and using their measures may misrepresent the nature of individual differences in attachment organization, distorting our understanding of the dynamics of adult attachment.

Supported by the findings of our study, these assumptions may also affect clinical practice. If a dimensional approach is adopted, clinicians may assume that the way their patients interact with intimate others and interpret their close relationships have two sources of variation: attachment-related anxiety and attachment-related avoidance. The former reflects a continuum of individual differences in *interpersonal* regulation (i.e. how individuals inspect and judge the availability and accessibility of their attachment figures), and the latter indicates the variations in *intrapersonal* regulation (i.e. how individuals regulate their attachment-related feelings, thoughts, and actions) (Fraley et al., 2015; Mikulincer & Shaver, 2016). In opposition to this approach which allows clinicians to better understand complex interactions between such sources of inter- and intrapersonal variations, a typological approach assumes that patients classified in a given attachment style tend to behave according to the descriptions of their categories. This assumption may compromise psychological assessment and the process of mapping out paths of change, as a typological approach makes it difficult to identify change as it considers the classificatory profile of the individual rather than the functioning of the spectrum of attachment dimensions.

Limitations

Although the findings are valuable in their own right, it is important to highlight a number of limitations: 1) due to the cross-sectional nature of the study, it was not possible to conduct a test-retest reliability analysis of the exploratory analyses (EFA and EGA) models; 2) the sample composition (demographic homogeneity) could have impacted upon the findings. Therefore, the two-dimensional post-hoc model which emerged from the exploratory analyses (Model 10 – with best psychometric properties) should be tested in other datasets, as its generalizability is uncertain; 3) relationship status may have influenced participants' responses. The categories available in the dataset were insufficient to inform specific details about relationship status. For example: it is unknown whether 'never married' means being single or living with a partner. Future studies should address this issue.

Conclusion

In this study we conducted an in-depth psychometric investigation of the RSQ using traditional (EFA, CFA) and contemporary (EGA) exploratory techniques. Although the RSQ was developed to assess four categories of adult attachment (categorical approach – i.e., secure, preoccupied, dismissing, fearful), our findings do not support the hypothesis that the RSQ delivers a psychometrically consistent measure of adult attachment styles. The results of the present study support the assumption that a two-dimensional approach (i.e., anxiety and avoidance) to assessing adult attachment is optimal.

References

Ainsworth, M. D. S. (1964). Patterns of attachment behavior shown by the infant in interaction with his mother. *Merrill-Palmer Quarterly of Behavior and Development*, *10*(1), 51–58.

Ainsworth, M. D. S., Blehar, M. C., Waters, E., & Wall, S. (1978). *Patterns of Attachment: A Psychological Study of the Strange Situation*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Ainsworth, M. D. S., & Bowlby, J. (1991). An ethological approach to personality development. *American Psychologist*, *46*(4), 333–341.

Andersen, C. M., Pedersen, A. F., Carlsen, A. H., Olesen, F., & Vedsted, P. (2017). Data quality and factor analysis of the Danish version of the Relationship Scale Questionnaire. *PLoS ONE*, *12*(5), 1–14. https://doi.org/10.1371/journal.pone.0176810

Bäckström, M., & Holmes, B. M. (2001). Measuring adult attachment: a construct validation of two self-report instruments. *Scandinavian Journal of Psychology*, *42*(1), 79–86. https://doi.org/10.1111/1467-9450.00216

Barnes, M. A., & Caltabiano, M. L. (2017). The interrelationship between orthorexia nervosa, perfectionism, body image and attachment style. *Eating and Weight Disorders*, *22*(1), 177–184. https://doi.org/10.1007/s40519-016-0280-x

Bartholomew, K., & Horowitz, L. M. (1991). Attachment Styles Among Young Adults: A Test of a Four-category Model. *Journal of Personality and Social Psychology*, *61*(2), 226–244. https://doi.org/10.1037/0022-3514.61.2.226

Bartholomew, K., & Shaver, P. R. (1998). Methods of assessing adult attachment: Do they converge? In J. A. Simpson & W. S. Rholes (Eds.), *Attachment theory and close relationships.* (pp. 25–45). New York: Guilford Press.

Bentler, P. M., & Bonett, D. G. (1980). Significance tests and goodness of fit in the analysis of covariance structures. *Psychological Bulletin*, *88*(3), 588–606. https://doi.org/10.1037/0033-2909.88.3.588

Borsboom, D., & Cramer, A. O. (2013). Network analysis: An integrative approach to the structure of psychopathology. *Annual Review of Clinical Psychology*, *9*, 91–121. https://doi.org/10.1146/annurev-clinpsy-050212-185608 [doi]

Brennan, K. A., Clark, C. L., & Shaver, P. R. (1998). Self-report Measurement of Adult Attachment: An Integrative Overview. In J. A. Simpson & W. S. Rholes (Eds.), *Attachment Theory and Close Relationships* (pp. 46–76). New York: Guilford Press.

Bretherton, I. (1992). The origins of attachment theory: John Bowlby and Mary Ainsworth. *Developmental Psychology*, *28*(5), 759–775.

Brown, R. J., Bouska, J. F., Frow, A., Kirkby, A., Baker, G. A., Kemp, S., … Reuber, M. (2013). Emotional dysregulation, alexithymia, and attachment in psychogenic nonepileptic seizures. *Epilepsy & Behavior*, *29*(1), 178–183. https://doi.org/10.1016/j.yebeh.2013.07.019

Brussoni, M. J., Jang, K. L., Livesley, W. J., & Macbeth, T. M. (2000). Genetic and environmental influences on adult attachment styles. *Personal Relationships*, *7*(3), 283–289. https://doi.org/10.1111/j.1475-6811.2000.tb00017.x

Cattell, R. B. (1966). The scree test for the number of factors. *Multivariate Behavioral Research*, *1*(2), 245–276. https://doi.org/10.1207/s15327906mbr0102_10

Cicero, V., Lo Coco, G., Gullo, S., & Lo Verso, G. (2009). The role of attachment dimensions and perceived social support in predicting adjustment to cancer. *Psycho-Oncology*, *18*(10), 1045–1052. https://doi.org/10.1002/pon.1390

Ciechanowski, P., Sullivan, M., Jensen, M., Romano, J., & Summers, H. (2003). The relationship of attachment style to depression, catastrophizing and health care utilization in patients with chronic pain. *Pain*, *104*(3), 627–637. Retrieved from http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=yrovftf&NEWS=N&AN=00006396-200308000-00022

Collins, N. L. (1996). Working models of attachment: Implications for explanation, emotion, and behavior. *Journal of Personality and Social Psychology*, *71*(4), 810–832. https://doi.org/10.1037//0022-3514.71.4.810

Comrey, A. L., & Lee, H. B. (1992). *A first course in factor analysis*. *A first course in factor analysis, 2nd ed.* (2nd ed.). Hillsdale: Lawrence Erlbaum Associates.

Constantino, M. J., Adams, M. L., Pazzaglia, A. M., Bernecker, S. L., Ravitz, P., & McBride, C. (2013). Baseline patient characteristics as predictors of remission in interpersonal psychotherapy for depression. *Psychotherapy Research*, *23*(2), 190–200. https://doi.org/10.1080/10503307.2013.765997

Costello, A. B., & Osborne, J. W. (2005). Best Practices in Exploratory Factor Analysis: Four Recommendations for Getting the Most From Your Analysis. *Practical Assessment, Research & Evaluation*, *10*(7), 1–9. https://doi.org/10.1.1.110.9154

Courtney, M. G. R. (2013). Determining the number of factors to retain in EFA: Using the SPSS R-Menu v2.0 to make more judicious estimations. *Practical Assessment, Research & Evaluation*, *18*(8), 1–14. https://doi.org/10.2147/JHL.S35483

Creasey, G., & Ladd, A. (2005). Generalized and specific attachment representations: Unique and interactive roles in predicting conflict behaviors in close relationships. *Personality and Social Psychology Bulletin*. https://doi.org/10.1177/0146167204274096

Donders, A. R. T., van der Heijden, G. J. M. G., Stijnen, T., & Moons, K. G. M. (2006). Review: A gentle introduction to imputation of missing values. *Journal of Clinical Epidemiology*, *59*(10), 1087–1091. https://doi.org/10.1016/J.JCLINEPI.2006.01.014

Feeney, J. A., & Hohaus, L. (2001). Attachment and spousal caregiving. *Personal Relationships*, *8*(1), 21–39. https://doi.org/10.1111/j.1475-6811.2001.tb00026.x

Forkmann, T., Teismann, T., Stenzel, J. S., Glaesmer, H., & De Beurs, D. (2018). Defeat and entrapment: More than meets the eye? Applying network analysis to estimate dimensions of highly correlated constructs. *BMC Medical Research Methodology*, *18*(1). https://doi.org/10.1186/s12874-018-0470-5

Fraley, R. C., & Bonanno, G. A. (2004). Attachment and loss: A test of three competing models on the association between attachment-related avoidance and adaptation to bereavement. *Personality and Social Psychology Bulletin*, *30*(7), 878–890. https://doi.org/10.1177/0146167204264289

Fraley, R. C., Heffernan, M. E., Vicary, A. M., & Brumbaugh, C. C. (2011). The experiences in close relationships-Relationship Structures Questionnaire: A method for assessing attachment orientations across relationships. *Psychological Assessment*, *23*(3), 615–625.

Fraley, R. C., & Shaver, P. R. (2000). Adult Romantic Attachment: Theoretical Developments, Emerging Controversies, and Unanswered Questions. *Review of General Psychology*, *4*(2), 132–154. https://doi.org/10.1037/1089-2680.4.2.132

Fraley, R. C., & Waller, N. G. (1998). Adult attachment patterns: A test of the typological model. In J. A. Simpson & W. S. Rholes (Eds.), *Attachment theory and close relationships* (1st ed., pp. 77–114). New York: Guilford Press.

Fraley, R. C., Waller, N. G., & Brennan, K. A. (2000). An item-response theory analysis of self-report measures of adult attachment. *Journal of Personality and Social Psychology*, *78*(2), 350–365. https://doi.org/10.1037/0022-3514.78.2.350

Fraley, C. R., Hudson, N. W., Heffernan, M. E., & Segal, N. (2015). Are adult attachment styles categorical or dimensional? A taxometric analysis of general and relationship-specific attachment orientations. *Journal of Personality and Social Psychology*, *109*(2), 354–368. https://doi.org/10.1037/pspp0000027

Golino, H. F., & Demetriou, A. (2017). Estimating the dimensionality of intelligence like data using Exploratory Graph Analysis. *Intelligence*, *62*, 54–70. https://doi.org/10.1016/j.intell.2017.02.007

Golino, H. F., & Epskamp, S. (2017). Exploratory graph analysis: A new approach for estimating the number of dimensions in psychological research. *PLoS ONE*, *12*(6), e0174035. https://doi.org/10.1371/journal.pone.0174035

Griffin, D. W., & Bartholomew, K. (1994a). The metaphysics of measurement: The case of adult attachment. In Kim Bartholomew & Daniel Perlman (Eds.), *Advances in Personal Relationships: Attachment Processes in Adulthood* (Vol. 5, pp. 17–52). London: Jessica Kingsley Publishers.

Griffin, D. W., & Bartholomew, K. (1994b). Models of the self and other: Fundamental dimensions underlying measures of adult attachment. *Journal of Personality and Social Psychology*, *67*(3), 430–445. https://doi.org/10.1037/0022-3514.67.3.430

Guédeney, N., Fermanian, J., & Bifulco, A. (2009). La version française du relationship scales questionnaire de Bartholomew (RSQ, Questionnaire des échelles de relation): Étude de validation du construit. *Encephale*, *36*(1), 69–76. https://doi.org/10.1016/j.encep.2008.12.006

Harrington, D. (2009). *Confirmatory Factor Analysis (Pocket Guides To Social Work Research Methods)*. *Pocket Guides to Social Work Research Methods*. New York: Oxford University

Press.

Haukoos, J. S., & Newgard, C. D. (2007). Advanced Statistics: Missing Data in Clinical Research-Part 1: An Introduction and Conceptual Framework. *Academic Emergency Medicine*, *14*(7), 662–668. https://doi.org/10.1197/j.aem.2006.11.037

Hazan, C., & Shaver, P. (1987). Romantic Love Conceptualized as an Attachment Process. *Journal of Personality and Social Psychology*, *52*(3), 511–524. https://doi.org/10.1037/0022-3514.52.3.511

Hazan, C., & Shaver, P. R. (1994). Attachment as an Organizational Framework for Research on Close Relationships. *Psychological Inquiry*, *5*(1), 1–22. https://doi.org/10.1207/s15327965pli0501_1

Hazan, C., & Shaver, P. R. (1994). Deeper Into Attachment Theory. *Psychological Inquiry*, *5*(1), 68–79. https://doi.org/10.1207/s15327965pli0501_15

Henseler, J., Ringle, C. M., & Sarstedt, M. (2014). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, *43*(1), 115–135. https://doi.org/10.1007/s11747-014-0403-8

Hu, L. T., & Bentler, P. M. (1998). Fit Indices in Covariance Structure Modeling: Sensitivity to Underparameterized Model Misspecification. *Psychological Methods*, *3*(4), 424–453. https://doi.org/10.1037/1082-989X.3.4.424

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, *6*(1), 1–55. https://doi.org/10.1080/10705519909540118

Ilhan, T. (2012). Loneliness among University Students: Predictive Power of Sex Roles and Attachment Styles on Loneliness. *Kuram Ve Uygulamada Egitim Bilimleri*, *12*(4), 2387–

2396.

Kaiser, H. F. (1974). An index of factorial simplicity. *Psychometrika*, *39*(1), 31–36. https://doi.org/10.1007/BF02291575

Keith, T. Z., Caemmerer, J. M., & Reynolds, M. R. (2016). Comparison of methods for factor extraction for cognitive test-like data: Which overfactor, which underfactor? *Intelligence*, *54*, 37–54. https://doi.org/10.1016/j.intell.2015.11.003

Kobak, R. R., Cole, H. E., Ferenz-Gillies, R., Fleming, W. S., & Gamble, W. (1993). Attachment and Emotion Regulation during Mother-Teen Problem Solving: A Control Theory Analysis. *Child Development*, *64*(1), 231. https://doi.org/10.2307/1131448

Kurdek, L. A. (2002). On being insecure about the assessment of attachment styles. *Journal of Social and Personal Relationships*, *19*(6), 811–834. https://doi.org/10.1177/0265407502196005

Li, C. H. (2016). Confirmatory factor analysis with ordinal data: Comparing robust maximum likelihood and diagonally weighted least squares. *Behavior Research Methods*, *48*(3), 936–949. https://doi.org/10.3758/s13428-015-0619-7

Li, S., Galynker, I. I., Briggs, J., Duffy, M., Frechette-Hagan, A., Kim, H.-J., … Yaseen, Z. S. (2017). Attachment style and suicide behaviors in high risk psychiatric inpatients following hospital discharge: The mediating role of entrapment. *Psychiatry Research*, *257*, 309–314. https://doi.org/10.1016/j.psychres.2017.07.072

Little, R. J. A., & Rubin, D. B. (2002). *Statistical Analysis with Missing Data* (2nd ed.). Hoboken, NJ: John Wiley & Sons.

Liu, C., Chen, X., Song, P., Lu, A., Wang, L., Zhang, X., … Zheng, D. (2018). Relationship between childhood emotional abuse and self-esteem: A dual mediation model of attachment.

Social Behavior and Personality: An International Journal, *46*(5), 793–800. https://doi.org/10.2224/sbp.6655

Lopez, F. G. (1995). Contemporary Attachment Theory: An Introduction with Implications for Counseling Psychology. *The Counseling Psychologist*, *23*(3), 395–415. https://doi.org/10.1177/0011000095233001

Marvin, R. S., & Britner, P. A. (1999). Normative Development: The Ontogeny of Attachment. In J. Cassidy & P. R. Shaver (Eds.), *Handbook of Attachment: Theory, Research and Clinical Applications* (1st ed., pp. 44–67). New York: The Guildford Press.

Massey, S. H., Compton, M. T., & Kaslow, N. J. (2014). Attachment Security and Problematic Substance Use in Low-Income, Suicidal, African American Women. *American Journal on Addictions*, *23*(3), 294–299. https://doi.org/http://dx.doi.org/10.1111/j.1521-0391.2014.12104.x

Maunder, R. G., & Hunter, J. J. (2012). A Prototype-Based Model of Adult Attachment for Clinicians. *Psychodynamic Psychiatry*, *40*(4), 549–573. https://doi.org/10.1521/pdps.2012.40.4.549

Mikulincer, M., & Shaver, P. R. (2016). Measurement of Attachment-related constructs in Adulthood. In M. Mikulincer & P. R. Shaver (Eds.), *Attachment in Adulthood: Structure, Dynamics, and Change* (2nd ed., pp. 75–108). New York: The Guildford Press.

Molaie, A. M., Chiu, C.-Y., Habib, Z., Galynker, I., Briggs, J., Rosenfield, P. J., … Yaseen, Z. S. (2019). Emotional pain mediates the link between preoccupied attachment and non-suicidal self-injury in high suicide risk psychiatric inpatients. Frontiers in Psychology, 10, 1–8. https://doi.org/10.3389/fpsyg.2019.00289

Newgard, C. D., & Haukoos, J. S. (2007). Advanced Statistics: Missing Data in Clinical

Research-Part 2: Multiple Imputation. Academic Emergency Medicine, 14(7), 669–678. https://doi.org/10.1111/j.1553-2712.2007.tb01856.x

O'Connor, B. P. (2000). SPSS and SAS programs for determining the number of components using parallel analysis and Velicer's MAP test. *Behavior Research Methods, Instruments, & Computers*, *32*(3), 396–402. https://doi.org/10.3758/BF03200807

Otani, K., Suzuki, A., Matsumoto, Y., Enokido, M., Shirata, T., K., O., … M., E. (2016). Effects of perceived affectionless control parenting on working models of the self and other. *Psychiatry Research*, *242*, 315–318. https://doi.org/10.1016/j.psychres.2016.05.018

Pennel, L., Quesada, J.-L., & Dematteis, M. (2018). Neuroticism and anxious attachment as potential vulnerability factors of repeat suicide attempts. *Psychiatry Research*, *264*, 46–53. https://doi.org/10.1016/j.psychres.2018.03.064

Pons, P., & Latapy, M. (2006). Computing Communities in Large Networks Using Random Walks. *Journal of Graph Algorithms and Applications*, *10*(2), 191–218. https://doi.org/10.7155/jgaa.00124

Raubenheimer, J. (2004). An item selection procedure to maximise scale reliability and validity. *SA Journal of Industrial Psychology*, *30*(4), 59–64. https://doi.org/10.4102/sajip.v30i4.168

Ravitz, P., Maunder, R., Hunter, J., Sthankiya, B., & Lancee, W. (2010). Adult attachment measures: A 25-year review. *Journal of Psychosomatic Research*, *69*(4), 419–432. https://doi.org/10.1016/J.JPSYCHORES.2009.08.006

Reis, S., & Grenyer, B. F. S. (2002). Pathways to anaclitic and introjective depression. *Psychology and Psychotherapy: Theory, Research and Practice*, *75*(4), 445–459. https://doi.org/10.1348/147608302321151934

Roisman, G. I., Holland, A., Fortuna, K., Fraley, R. C., Clausell, E., & Clarke, A. (2007). The

Adult Attachment Interview and Self-Reports of Attachment Style: An Empirical Rapprochement. *Journal of Personality and Social Psychology*, *92*(4), 678–697. https://doi.org/10.1037/0022-3514.92.4.678

Rosseel, Y. (2012). lavaan : An R Package for Structural Equation Modeling. *Journal of Statistical Software*, *48*(2). https://doi.org/10.18637/jss.v048.i02

Ruscio, J., & Roche, B. (2012). Determining the number of factors to retain in an exploratory factor analysis using comparison data of known factorial structure. *Psychological Assessment, 24*(2), 282-292. doi:10.1037/a0025697

Scharfe, E., & Bartholomew, K. (1994). Reliability and stability of adult attachment patterns. *Personal Relationships*, *1*(1), 23–43. https://doi.org/10.1111/j.1475-6811.1994.tb00053.x

Shaver, P. R., Hazan, C., & Bradshaw, D. (1988). Love as attachment: The integration of three behavioral systems. In R. J. Sternberg & M. Barnes (Eds.), *The psychology of love* (pp. 68–99). New Haven, CT: Yale University Press.

Siegert, R. J., Ward, T., & Hudson, S. (1995). The structure of romance: A factor-analytic examination of the Relationship Scales Questionnaire. *New Zealand Journal of Psychology*, *1*(24), 13–20.

Simpson, J. A., Rholes, W. S., & Nelligan, J. S. (1992). Support seeking and support giving within couples in an anxiety-provoking situation: The role of attachment styles. *Journal of Personality and Social Psychology*, *62*(3), 434–446. https://doi.org/10.1037/0022-3514.62.3.434

Sperling, M. B., Foelsch, P., & Grace, C. (1996). Measuring adult attachment: Are self-report instruments congruent? *Journal of Personality Assessment*, *67*(1), 37–51. https://doi.org/10.1207/s15327752jpa6701_3

Steffanowski, A., Oppl, M., Meyerberg, J., Schmidt, J., Wittmann, W. W., & Nübling, R. (2001). Empirische Ergebnisse Psychometrische Überprüfung einer deutschsprachigen Version des Relationship Scales Questionaire (RSQ). *Störungsspezifische Therapieansätze - Konzepte Und Ergebnisse.*, (2001), 320–342.

Stein, H., Koontz, A. D., Fonagy, P., Allen, J. G., Fultz, J., Brethour, J. R., … Evans, R. B. (2002). Adult attachment: What are the underlying dimensions? *Psychology and Psychotherapy: Theory, Research and Practice*, *75*(1), 77–91. https://doi.org/10.1348/147608302169562

Sterne, J. A. C., White, I. R., Carlin, J. B., Spratt, M., Royston, P., Kenward, M. G., … Carpenter, J. R. (2009). Multiple imputation for missing data in epidemiological and clinical research: Potential and pitfalls. *BMJ (Clinical Research Ed.)*, *338*(b2393). https://doi.org/10.1136/bmj.b2393

Waters, E., Merrick, S., Treboux, D., Crowell, J., & Albersheim, L. (2000). Attachment security in infancy and early adulthood: A twenty-year longitudinal study. *Child Development*, *71*(3), 684–689. https://doi.org/10.1111/1467-8624.00176

Yaseen, Z. S., Galynker, I. I., Cohen, L. J., & Briggs, J. (2017). Clinicians' conflicting emotional responses to high suicide-risk patients – Association with short-term suicide behaviors: A prospective pilot study. *Comprehensive Psychiatry*, *76*, 69–78. https://doi.org/10.1016/j.comppsych.2017.03.013

Table 1

Standardized loading of each item on its hypothesized factor for each of the models derived from the confirmatory factor analyses of RSQ items.

Items	Replication Models							Novel Models		
	1	2	3	4	5	6	7	8	9	10
1	.58	-.40	–	-.77	.61	–	.66	.87	.76	–
2	–	–	–	-.29	.22	-.17	.51	.39	–	–
3	–	–	–	.60	-.51	.74	.42	.76	-.55	–
4	.11	.11	–	.10	–	.17	–	.22	.57	–
5	–	–	–	.69	–	.63	.63	.67	.67	–
6	–	–	–	-.33	.29	–	-.02/.39*	.27	.30	.18
7	.69	–	–	.63	.68	–	–	.63	.63	–
8	–	–	–	.20	-.16	.28	-.01	.02	.77	–
9	–	–	–	.41	.36	.49	-.21	.50	.44	.46
10	-.48	-.40	-.40	.68	-.54	.59	.54	-.54	-.73	–
11	.82	.86	.83	.73	-.72	.76	–	.78	.82	.82
12	.78	.75	.73	.75	.75	.68	.71	.75	.72	–
13	.83	.72	.82	.68	.78	–	–	.84	.81	.87
14	–	–	–	.18	-.16	.27	–	.08	.71	–
15	-.26	-.22	-.27	–	-.29	–	.17	–	-.30	–
16	–	–	–	.65	.62	.68	.75	.58	.68	.66
17	.71	–	–	.65	.71	.60	–	.70	.71	–
18	.41	.40	.40	.36	–	.40	–	–	.34	–
19	–	–	–	–	.23	–	.52	.44	–	–
20	.80	–	.81	–	.77	–	–	.85	.84	.85
21	.86	.89	.88	.77	.76	.82	–	.81	.86	.88
22	–	–	–	–	.47	–	–	–	.47	–
23	.73	.57	.70	.68	.67	.72	–	.70	.76	.77
24	.81	.75	.78	–	.79	–	.68	.86	.86	.85
25	.52	.49	.49	.48	–	.51	.55	.59	.52	.50
26	–	–	–	-.64	.53	–	.86	.69	.62	–
27	.67	–	–	–	-.65	–	–	-.63	-.64	–
28	–	–	–	.57	.56	.61	-.45	.78	.63	.64
29	.53	.50	.52	–	–	-.50	–	.59	.58	.57
30	-.59	-.49	-.54	.69	-.61	.83	–	.89	-.65	–
CFA Indexes										
CMIN/DF	4.843	8.971	3.643	11.968	11.084	12.767	14.465	5.792	3.326	3.122
CFI	.957	.905	.975	.829	.846	.821	.749	.875	.936	.969
GFI	.993	.990	.996	.979	.980	.981	.985	.978	.985	.994
AGFI	.990	.983	.994	.972	.975	.974	.977	.971	.981	.990
SRMR	.072	.093	.058	.117	.115	.118	.119	.114	.088	.073
RMSEA	.073	.106	.061	.124	.119	.128	.137	.116	.081	.077
PCLOSE	.0001	.0001	.017	.0001	.0001	.0001	.0001	.0001	.0001	.0001

Note: Dashes indicate coefficient was not calculated. Replication Models: Model 1 tests Collins's (1996) structure; Model 2, the Hazan and Shaver (1987) model; Model 3, the Simpson, Rholes, and Nelligan (1992) model; Model 4, the Feeney and Hohaus (2001) model; Model 5, the Fraley and Bonanno (2004) model; Model 6, the Creasey and Ladd (2005) model; and Model 7, the Griffin and Bartholomew (1994a) model. Novel Models (from the present study): Model 8 tests the results from the EFA, Model 9 tests the outcome of the EGA Network Analysis, and the Model 10 tests the 2-factor parsimonious model from the combination of outcomes from the EFA and the EGA solutions. *Factor loadings for Item 6 load on both preoccupied and dismissive, respectively, according to Griffin and Bartholomew (1994a).

Table 2

Standardized loading of each item on its hypothesized factor for each of the models derived from the confirmatory factor analyses of RSQ items.

Item		Factors						
		1	2	3	4	5	6	7
15	I am comfortable having other people depend on me.	**1.029**	.021	.016	.099	.028	.160	.136
22	I prefer not to have other people depend on me.	**-.598**	-.029	.019	.179	-.087	.236	.094
11	I often worry that romantic partners don't really love me.	.026	**.910**	-.005	-.021	-.052	.019	-.081
21	I often worry that romantic partners won't want to stay with me.	-.017	**.849**	-.037	.036	-.086	.015	.123
12*	I find it difficult to trust others completely.	-.084	**.413**	.005	.103	.351*	.161	.020
23*	I worry about being abandoned.	-.046	**.340**	.002	-.071	.183	.099	.317*
3	I find it easy to get emotionally close to others.	.115	-.056	**.685**	.061	-.038	-.176	.045
30	I find it relatively easy to get close to others.	.146	-.080	**.675**	.082	-.187	-.085	-.100
4	I want to merge completely with another person.	-.153	.094	**.346**	-.116	.099	-.008	.150
18	My desire to merge completely sometimes scares people away.	-.057	.163	.288	-.196	.163	.234	.073
2	It is very important to me to feel independent.	-.012	.079	.055	**.698**	-.061	-.028	-.058
19	It is very important to me to feel self-sufficient.	.033	-.052	.023	**.676**	-.096	.101	.100
26	I prefer not to depend on others.	-.103	-.032	-.074	**.539**	.220	.152	.024
1	I find it difficult to depend on other people.	-.009	-.006	-.208	**.405**	.376	.102	.043
17	People are never there when you need them.	-.016	-.049	.025	-.141	**.720**	.170	.076
27	I know that others will be there when I need them.	.058	-.001	.143	.130	**-.710**	.010	.025
7	I am not sure that I can always depend on others to be there when I need them.	.043	.159	.091	.208	**.663**	.059	-.008
16*	I worry that others don't value me as much as I value them.	.073	.229	-.059	-.041	**.434**	-.075	.398*
10*	I am comfortable depending on other people.	.161	-.072	.225	-.333*	**-.422**	.178	.206
5*	I worry that I will be hurt if I allow myself to become too close to others.	-.006	.333*	.185	.174	**.358**	.170	.061
24	I am somewhat uncomfortable being close to others.	-.106	.014	-.275	-.017	.026	**.668**	.104
20	I am nervous when anyone gets too close to me.	-.134	.211	-.102	.067	-.052	**.602**	.065
13	I worry about others getting too close to me.	-.069	.162	.077	.097	.200	**.585**	-.030
29	Romantic partners often want me to be closer than I feel comfortable being.	-.063	.065	-.074	.087	-.018	**.476**	-.082
6	I am comfortable without close emotional relationships.	.030	.002	.010	.119	.076	**.364**	-.236

28	I worry about having others not accept me.	.021	.136	-.185	.059	.108	.086	**.618**
14	I want emotionally close relationships.	.069	.015	.136	.110	-.096	-.169	**.529**
8	I want to be completely emotionally intimate with others.	.035	.033	.224	.009	-.034	-.092	**.486**
9	I worry about being alone.	-.061	.294	-.023	-.146	-.016	-.031	**.467**
25	I find that others are reluctant to get as close as I would like.	-.015	.037	.031	-.082	.221	.221	**.380**

Note: Extraction Method: Maximum Likelihood. Rotation Method: Oblimin with Kaiser Normalization. Rotation converged in 17 iterations.
*Items with factor loadings fitting in more than one factor. Items retained in the analysis on the factors they had loaded the highest on. Boldfaced values represent the items that predominate each factor.

Table 3

Validity and reliability indices for the RSQ models that presented an acceptable CFA fit.

Model	*Factors*	*α*	*Omega Indices*			*HTMT*
			ω	*S.E.*	*95%C.I.*	
1	Dependence (D)	.03	.43	.029	.381 – .497	*htmt*(*D,A*) = .59 *htmt*(*D,C*) = .78 *htmt*(*A,C*) = .51
	Anxiety (A)	.77	.79	.012	.766 – .815	
	Closeness (C)	.37	.60	.021	.565 – .648	
3	Anxiety (A)	.80	.82	.010	.805 – .846	*htmt*(*A,V*) = .56
	Avoidance (V)	.39	.58	.022	.534 – .622	

8	Relationship Worry (W)	.84	.85	.012	.831 – .897	*htmt*(*W,C*) = .41; *htmt*(*W,I*) = .34;
						htmt(*W,T*) = .85; *htmt*(*W,V*) = .67;
						htmt(*W,S*) = .63; *htmt*(*C,I*) = .46;
						htmt(*C,T*) = .55; *htmt*(*C,V*) = .70;
						htmt(*C,S*) = .56; *htmt*(*I,T*) = .61;
						htmt(*I,V*) = .60; *htmt*(*I,S*) = .29;
						htmt(*T,V*) = .77; *htmt*(*T,S*) = .55;
						htmt(*V,S*) = .52;

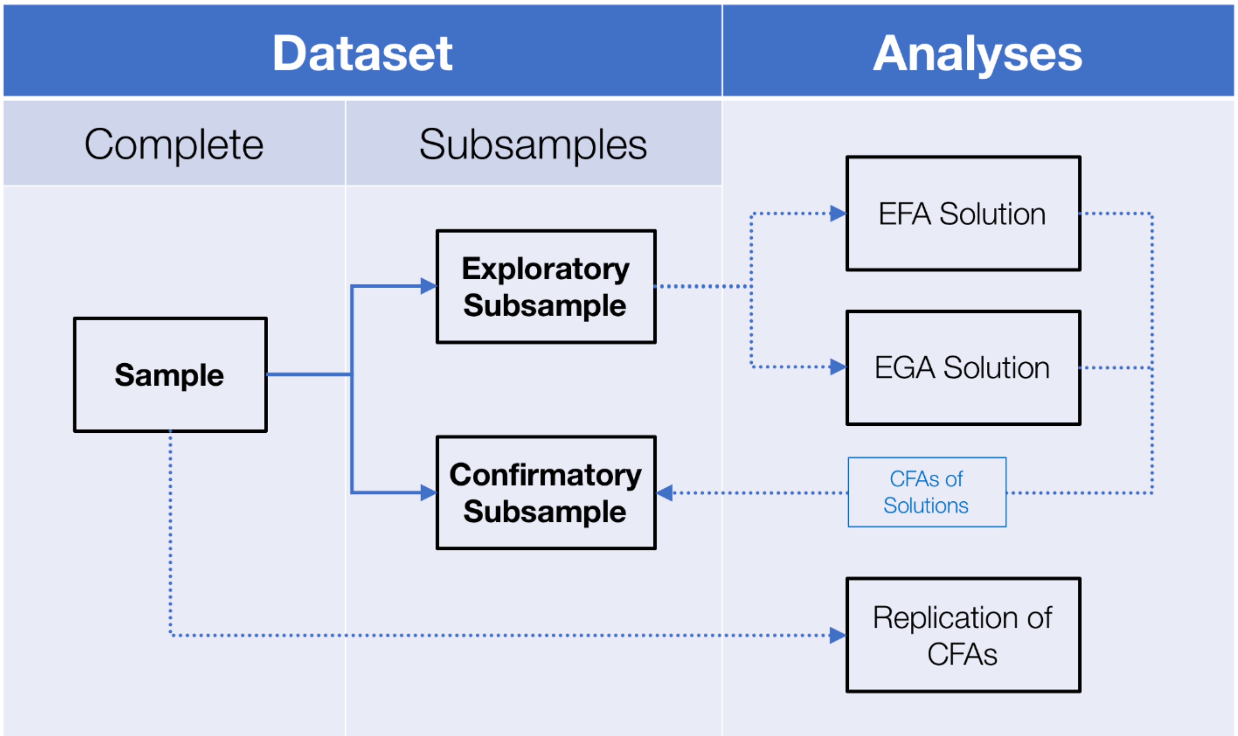
	Closeness (C)	.64	.73	.034	.668 – .802	
	Independence (I)	.74	.72	.027	.668 – .774	
	Lack of Trust (T)	.09	.40	.044	.312 – .488	
	Avoidance (V)	.81	.83	.013	.802 – .857	
	Fear of Separation (S)	.70	.68	.033	.614 – .746	

9	Dependence (D)	-.74	.29	.059	.123 – .356	*htmt*(*D,T*) = .69; *htmt*(*D,A*) = .35;
						htmt(*D,M*) = .30; *htmt*(*D,V*) = .72;
						htmt(*D,A*) = .35; *htmt*(*T,A*) = .73;
						htmt(*T,M*) = .21; *htmt*(*T,V*) = .76;
						htmt(*A,M*) = .48; *htmt*(*A,V*) = .47;
						htmt(*M,V*) = .48;

	Lack of Trust (T)	.39	.59	.042	.514 – .679	
	Anxiety (A)	.85	.86	.012	.838 – .885	
	Desire for Intimacy (M)	.69	.70	.026	.657 – .760	
	Avoidance (V)	.32	.53	.033	.464 – .597	
10	Anxiety (A)	.85	.86	.012	.838 – .885	*htmt*(*A,V*) = .52
	Avoidance (V)	.81	.83	.013	.802 – .857	

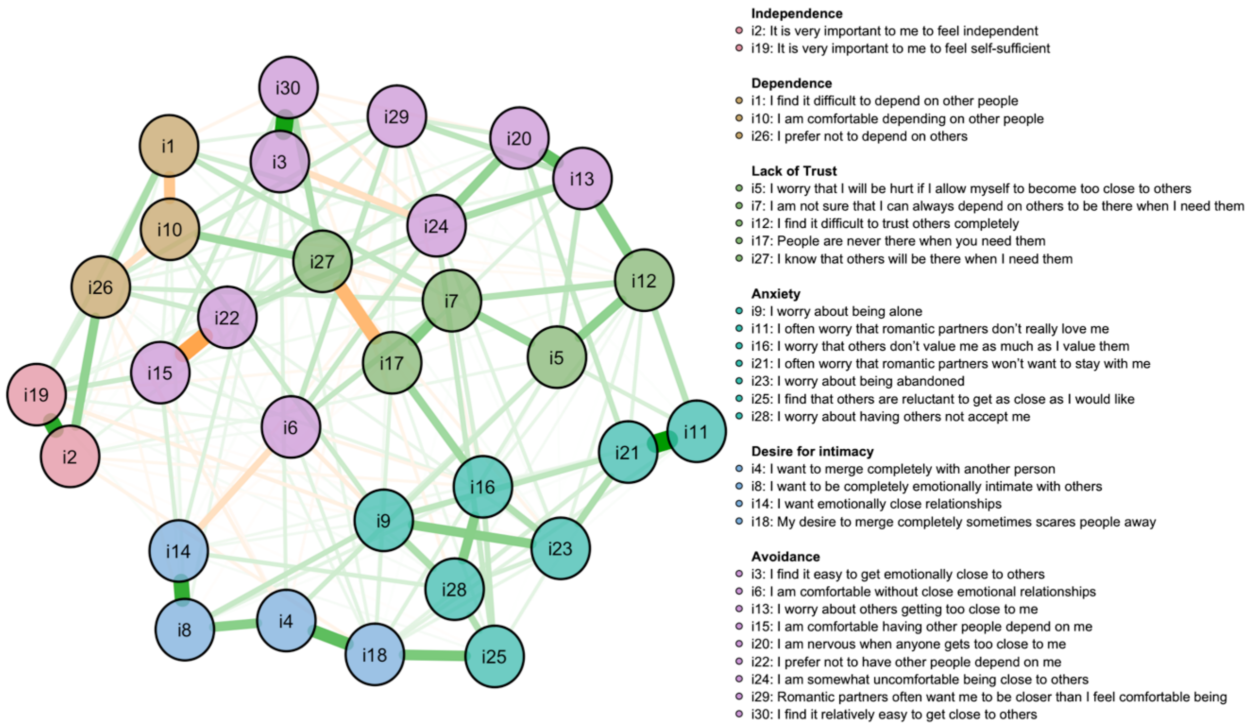
Note: Model 1: Collins (1996); Model 3: Simpson et al. (1992); Model 8: EFA 6-factor; Model 9: EGA 5-factor; Model 10: EFA-EGA 2-factor.

Figure 1



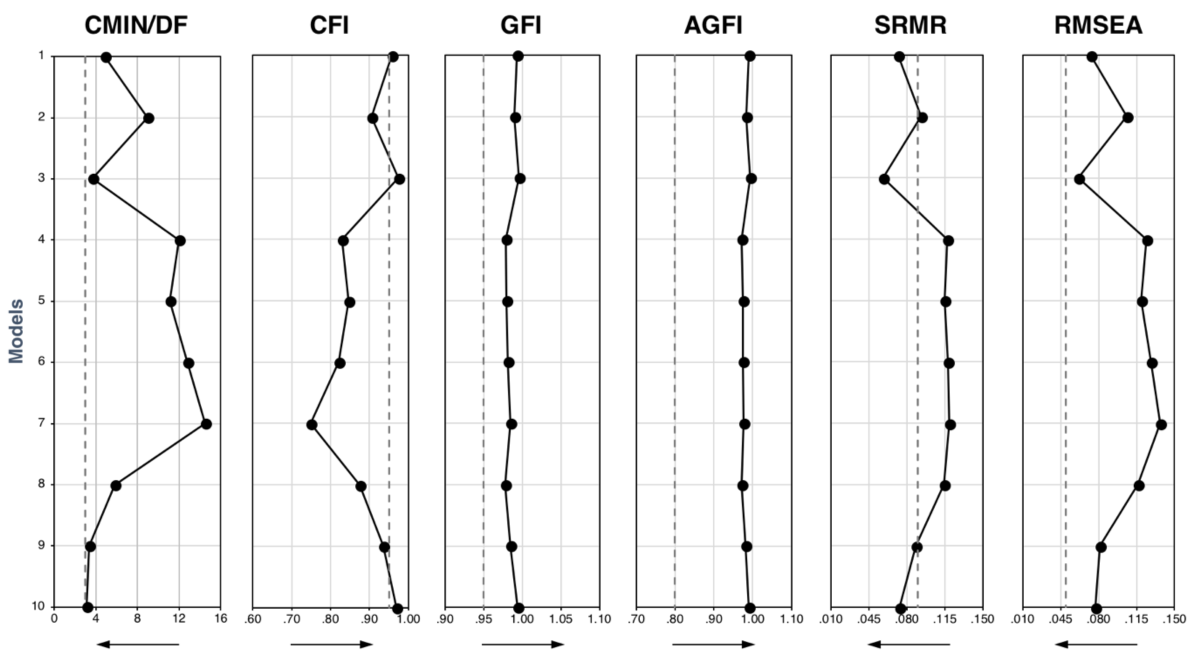
Analytical strategy.

Figure 2



Network analysis of the exploratory subsample from the Walktrap algorithm analytical process.

Figure 3



Aggregated plot comparing models' CFA performances. Dots and continuous lines represent models' CFA indexes; dashed lines represent the metric thresholds according to Hu and Bentler (1999); arrows indicate the direction to a better fit according to the cut-off criteria.