# EXPLORATORY STRUCTURE EQUATION MODELING OF THE UCLA LONELINESS SCALE: A CONTRIBUTION TO THE ITALIAN ADAPTATION

MARILISA BOFFO
STEFANIA MANNARINI
CRISTINA MUNARI
UNIVERSITY OF PADOVA

The present study aimed at exploring the dimensionality of the Italian version of the UCLA Loneliness Scale-version 3 (UCLA LS3), in relation to self-esteem (Rosenberg Self-Esteem Scale — RSES), social anxiety (Social Interaction Anxiety Scale — SIAS), and adult attachment (Attachment Style Questionnaire — ASQ), in 350 Italian young adults. An innovative Exploratory Structure Equation Modeling approach (ESEM — Asparouhov & Muthén, 2009) was used. Thanks to the combination of explorative (EFA) and confirmative (CFA) factor analysis methods, ESEM allowed to simultaneously estimate an EFA measurement model with rotations and a traditional SEM model, to investigate UCLA LS3 latent structure and convergent validity. A three-factor ESEM model presented a satisfactory fit to the data. The Italian UCLA LS3 scale resulted to be composed by the interrelated dimensions of Isolation, Relational Connectedness and "Trait" Loneliness. ESEM structural part showed ASQ subscales and SIAS to systematically predict loneliness dimensions, whereas the RSES affected only the Isolation factor.

Key words: Exploratory Structural Equation Modeling (ESEM); UCLA Loneliness Scale; Dimensionality; Convergent validity; Adaptation.

*Correspondence concerning this article should be addressed to Marilisa Boffo, Dipartimento FISPPA — Sezione di Psicologia Applicata, Università di Padova, Via Venezia 8, 35131 PADOVA (PD), Italy. E-mail: marilisa.boffo@gmail.com*

## INTRODUCTION

The present study was designed within a substantive-methodological synergy perspective (Marsh & Hau, 2007). It brings to bear a recent, evolving methodology pertaining to the Structural Equation Modeling (SEM) framework, to evaluate the dimensional structure of the first Italian adaptation of one of the most widely used self-report measures of loneliness construct, and to explore substantive relations between loneliness and relevant personality and social constructs, following a construct validation perspective.

Methodologically, we provided a demonstration of the strength, flexibility, and potential applications of the Exploratory Structural Equation Modeling (ESEM) method (Asparouhov & Muthén, 2009), which integrates many of the advantages of Confirmatory Factor Analysis (CFA), SEM, and Exploratory Factor Analysis (EFA), underlying the importance of applying new and evolving methodological approaches to substantively important issues.

Measurement instruments developed in personality and social psychology areas usually evidence an apparently well-defined EFA structure, but are not adequately supported by CFAs or do not even reach minimal standards of fit (Marsh et al., 2009). Typically, this is the result of their factor structure not being consistent with the highly restrictive independent clusters model (ICM) normally used in CFAs, in which each item is allowed to load on one and only one factor and all non-target loadings are constrained to be zero. The factor loading constraints tend to be too restrictive for personality and social psychology research, because indicators are likely to have small secondary cross-loadings, which are well motivated either by substantive theory or by measure development. Consequently, the inappropriate imposition of zero factor loadings usually leads to distorted factors with overestimated correlations that might entail biased estimates in SEMs incorporating other constructs (e.g., Asparouhov & Muthén, 2009; Marsh et al., 2010). This procedure may also force the researcher to an extensive use of modification indices to find a well-fitting model. According to this approach, CFA procedures become then exploratory rather than confirmatory, when the use of EFA with factor matrix rotations could be a better solution, in particular to discover misspecified loadings (Browne, 2001). The use of an EFA approach can provide an option that is more closely aligned with reality, reflecting more complex measurement structure (i.e., greater than 1) or more limited measurement knowledge and/or theoretical background of the researcher, which is the case of the present study. EFA models are well suited to data-driven studies without any a priori hypotheses on the optimal measurement model, but they are also well suited to theory-driven research, providing a strong test on the hypothesized relations between items and latent factor, imposing no ICM on the model. The recent development of ESEM methods (Asparouhov & Muthén, 2009) follows this perspective, extending SEM to allow less restrictive measurement models by integrating EFA within the CFA/SEM framework. What ESEM has in common with EFA is the parameter estimation, using maximum likelihood (ML) estimation or estimation methods robust to non-normality, and EFA familiar loading matrix rotation methods, which give transformation of both measurement and structural coefficients. On the other hand, ESEM has access to typical SEM features, for example, parameter standard errors, goodness-of-fit statistics, residual correlations, regression of factors on covariates (MIMIC approach), regression among latent factors, multiple-group analysis with intercept and mean structure, full measurement invariance test, and latent growth modeling.

## THE CONSTRUCT OF LONELINESS: THE UCLA LONELINESS SCALE

The University of California, Los Angeles, Loneliness Scale-version 3 (UCLA LS3; Russell, 1996) is the most widely used self-report measure for the assessment of adolescent and adult loneliness within several areas of clinical, personality, social, and job psychology research. The construct of loneliness has been extensively related to mental health outcomes (e.g., Heinrich & Gullone, 2006), particularly depression (e.g., Cacioppo, Hawkley, & Thisted, 2010; Cacioppo, Hughes, Waite, Hawkley, & Thisted, 2006), health outcomes (e.g., Hawkley, Burleson, Berntson, & Cacioppo, 2003; Hawkley, Thisted, & Cacioppo, 2009; Segrina & Domschkea, 2011), life satisfaction (e.g., Azimeh, 2011; Goodwin, Cook, & Yung, 2001; Mellor, Stokes, Firth, Hayashi, & Cummins, 2008), psychosocial well-being and internet use (e.g., Erickson & Johnson, 2011; Kim, LaRose, & Peng, 2009), workplace relationships (e.g., Erdil & Ertosun, 2011; Lam & Lau, 2012), work performance (Ozcelik & Barsade, 2011), and workaholism (Bovornusvakool, Vodanovich, Ariyabuddhiphongsb, & Ngamake, 2012).

Following the great feasibility and applicability characteristics of the scale, the UCLA LS3 has been largely adapted and validated in many different countries, including Argentina (Sacchi & Richaud de Minzi, 1997), Denmark (Lasgaard, 2007), South Africa (Pretoirus, 1993), Taiwan (Wu & Yao, 2008), and Turkey (Durak & Senol-Durak, 2010), but not in Italy.

This self-report scale was designed as a unidimensional measure, in accordance with the conceptualization of loneliness as an undifferentiated unitary state, experienced and understood in the same way by all lonely people, that varies only in intensity and is the result of deficits in a variety of relationships (Russell, 1996; Russell, Peplau, & Cutrona, 1980).

Despite the theoretical UCLA LS3 unidimensionality, the scale factorial structure remains rather controversial. Though many studies confirmed the validity and reliability of the unidimensional scale (e.g., Hartshorne, 1993; Lasgaard, 2007; Russell, 1996), others suggested that not all items load into a single underlying factor, highlighting a UCLA LS3 multidimensional factor structure (e.g., Durak & Senol-Durak, 2010; Dussault, Fernet, Austin, & Leroux, 2009; Hawkley, Browne, & Cacioppo, 2005; McWhirter, 1990).

One goal of the present study was therefore to provide a first attempt to adapt the UCLA LS3 to the Italian context and investigate its dimensionality. Further, the scale convergent validity with conceptually-related personality measures, such as adult attachment, social anxiety, and self-esteem, was examined. An ESEM approach was selected in the present study for two main reasons: firstly, the lack of a priori hypotheses on the measurement structure of the UCLA LS3 Italian version led to support an explorative approach to the scale; secondly, the ESEM possibility of simultaneously modeling an EFA measurement model with rotations and a standard SEM model with covariates, provided a powerful tool to test the scale internal structure and construct convergent validity.

## METHOD

### Participants

A sample of 350 university students (aged 19-50; $M$ = 22.903 years, $SD$ = 4.758; 31.36% males) was randomly recruited from various courses at the departments of Psychology, Sociology, Literature and Philosophy, Economy, Medicine, Engineering, and Physics, of the Universities of Trento and Pescara, Italy.

### Procedure and Measures

According to research standard ethical requirements, participants received an informative sheet on the study and were asked for written informed consent. They were advised that participation was voluntary and anonymous and they could drop out of the study at any time.

Participants completed a battery of self-report measures covering the constructs object of the present study and a socio-demographic form asking for general information (gender, age, University course). The self-report measures were administered to participants in a fixed order, to control for systematic order effects and the possible influence of personality constructs on each other.

*Attachment Style Questionnaire* (ASQ; Feeney, Noller, & Hanrahan, 1994). Adult attachment multidimensional self-report measure composed of 40 items evaluated on a 6-point

Likert-type scale from 1 (*completely disagree*) to 6 (*completely agree*). The questionnaire comprises five subscales, which identify five attachment components describing the underlying second-order dimensions of anxiety and avoidance in attachment relationships. The five subscales describe the following adult attachment components:

a. Confidence (eight items): ability to rely on one's individual resources and to trust in relationships; it reflects a secure attachment orientation;

b. Discomfort with closeness (10 items): avoidance of affective dependence through a counter-dependent attitude about relationships and relying only on oneself; it is a theme central to avoidant attachment;

c. Need for approval (seven items): respondents' need for acceptance and confirmation from others; it characterizes fearful and preoccupied attachment styles;

d. Preoccupation with relationships (eight items): anxious and dependent approach to relationships; it is a core feature of anxious/ambivalent attachment;

e. Relationships as secondary (seven items): relations not considered relevant and extreme importance to self-realization; it is consistent with the concept of dismissing attachment.

In the present study the Italian adaptation by Fossati et al. (2003) was administered.

*UCLA Loneliness Scale* (Version 3; Russell, 1996). Global loneliness self-report measure composed of 20 items evaluated on a 4-point Likert-type scale in accordance with the rate of frequency, ranging from 1 (*never*) to 4 (*always*). Nine items are positively formulated and score-reversed to obtain high total values indicating greater feelings of loneliness (score range: 20-80). The original English version was translated into Italian through a back-translation procedure following the guidelines developed by the International Committee of Psychologists of the International Test Commission (van de Vijver & Hambleton, 1996). According to these guidelines, the questionnaire was translated into Italian by a native English speaker and a native Italian speaker. The two versions were independently translated back into English by two Italian proficient in the English language and personality and social psychology. Comparisons and discussion of differences between these four versions resulted in no item changes. All four experts who worked on the back translation agreed on the appropriateness and clarity of the scale contents.

*Rosenberg Self-Esteem Scale* (RSES; Rosenberg, 1965). Self-report measure of global self-esteem composed of 10 items evaluated on a 4-point Likert-type scale from 1 (*completely disagree*) to 4 (*completely agree*). The Italian adaptation by Prezza, Trombaccia, and Armento (1997) was administered.

*Social Interaction Anxiety Scale* (SIAS; Mattick & Clarke, 1998). Mono-dimensional self-report measure of general social interaction preoccupation and anxiety, composed of 19 items evaluated on a 5-point Likert-type scale from 0 (*nothing at all*) to 4 (*completely*). Eight items are positively formulated and score-reversed to obtain total values indicating higher generalized social phobia. The Italian adaptation by Sica et al. (2007) was administered.

## Data Analyses

Preliminary UCLA LS3 items descriptive analyses were conducted to control for normality requirements. Skewness and kurtosis values for each item were calculated. Inter-item correlations were also computed.

In the first step, the unidimensional a priori structure of the UCLA LS3, as devised in Russell (1996) original version, was tested on the total sample with CFA to verify whether the UCLA LS3 theoretical unidimensionality was eventually supported in the Italian version of the scale.

In the second stage, three MIMIC ESEM models hypothesizing two, three, or four loneliness underlying latent factors were estimated on the total sample to explore at the same time the latent structure of the UCLA LS3 Italian, namely, the ESEM EFA measurement part, and the SEM structural relations between UCLA LS3 latent factors and the personality individual differences measures considered in the present study. These measures were entered as covariates in the ESEM model within a UCLA LS3 construct concurrent validation.

## The ESEM Model

A general ESEM model (Asparouhov & Muthén, 2009) posits $p$ dependent variables $Y = (Y_1, ..., Y_p)$, $q$ independent variables $X = (X_1, ..., X_q)$, and $m$ latent variables $\eta = (\eta_1, ..., \eta_m)$, under the standard assumptions that the ε and ζ are normally distributed residuals with mean 0 and variance covariance matrix θ and ψ, respectively. Λ is a factor loading matrix, whilst B and Γ are matrices of regression coefficients relating latent and independent variables to each other.

$$Y = \nu + \Lambda\eta + KX + \varepsilon \quad (1)$$

$$\eta = \alpha + B\eta + \Gamma X + \zeta \quad (2)$$

In the basic version of ESEM model, all parameters can be identified with the maximum likelihood (ML) estimation method. However, the model is generally not identified unless additional constraints are imposed. As in CFA analyses, the two typical approaches are to identify the metric of the latent variable by either fixing its variance to be 1 or by fixing one of the factor loadings for each factor typically to be 1. Though, the ESEM approach differs from the typical CFA approach in that all factor loadings are estimated. Thus, when the number of latent factor $m$ is greater than 1, a total of $m^2$ constraints are needed to identify both orthogonal and oblique models (for technical details see Asparouhov & Muthén, 2009).

The estimation of the ESEM model consists of several steps (Asparouhov & Muthén, 2009). For each block of exploratory latent variables $\eta = (\eta_1, ..., \eta_m)$ a block of manifest indicators $Y = (Y_1, ..., Y_p)$ is assigned. Note that different exploratory blocks can use the same factor indicators. The factor variance covariance matrix is specified as an identity matrix (ψ = I), giving $m(m + 1)/2$ restrictions. The exploratory factor loading matrix (Λ) for the block has all entries above the main diagonal (i.e., for the first $m$ rows and column in the upper right-hand corner of factor loading matrix, Λ), fixed to 0, providing remaining $m(m - 1)/2$ identifying restrictions. Initially a SEM model is estimated for each exploratory factor block using the ML estimator. This initial, unrotated, model provides starting values that can be subsequently rotated into an EFA model with $m$ factors. The asymptotic distribution of all parameter estimates in this starting value model is also computed. Then for each exploratory block or simple ESEM model the factor variance covariance matrix is computed (for extensive technical details, see Asparouhov & Muthén, 2009). In SEM Mplus software (Muthén & Muthén, 1998/2010) multiple random starting values are used in the estimation process to protect against non-convergence and local minimums in the rotation algorithms. Although a wide variety of orthogonal and oblique rotation procedures are available, leading authorities on this topic (e.g., Asparouhov & Muthén, 2009; Browne, 2001; Jennrich, 2006) have recommended Geomin rotation, in particular when little is known about the true loading structure and for simple to moderately complicated factor loading matrix (structure complexity up to 2). In the context of the present investigation, oblique Geomin rotation method seemed the preferable solution, given the previous contradictory results about the number of UCLA LS3 hypothesized latent factors. Geomin rotations also incorporate a complexity parameter ($\varepsilon$) which takes on small positive value that increases with the number of factors (Asparouhov & Muthén, 2009; Browne, 2001). In the present research, $\varepsilon$ values of .001 for the 2-factor, and .01 for the 3-and 4-factor ESEM models, were selected, to maintain a balance between the size of factor correlations and items cross-loadings (Browne, 2001). Nevertheless, consistent with recommendations (e.g., Browne, 2001; Jennrich, 2006), different $\varepsilon$ values were explored. There did not seem to be substantially different results in the UCLA LS3 factorial structure and factors contents based on the various $\varepsilon$ values, confirming that in ESEM the choice of rotation criterion typically does not consistently affect the rotated parameter estimates (Asparouhov & Muthén, 2009).

Though the general flexibility of the ESEM model, which incorporates most of classic CFA and SEM features, a number of restrictions are necessary: Exploratory factors have to simultaneously appear in a regression or be correlated with, namely, if a factor in an exploratory block is regressed on or correlated with a covariate $X_i$, all other factors in the block have to be regressed on or correlated with that covariate, meaning that the covariance parameters can either be simultaneously 0 or free and unconstrained. This is mainly due to the Geomin rotation criteria, which causes the factors to be interchangeable and it is not possible to specify a structural path using an exploratory factor without knowing which factor that is. For this reason, in the present study, the whole direct effect pattern of the independent variables on every loneliness factor was estimated.

A second restriction imposes the exploratory factors from the same block not to be regressed on each other and not to have a structured variance-covariance matrix such as second-order factor analysis (Asparouhov & Muthén, 2009).

## Goodness of Fit

Assessment of model goodness of fit is usually based on multiple indicators: the chi-square statistic ($\chi^2$), the Tucker-Lewis Index (TLI), the comparative fit index (CFI), the root mean square error of approximation (RMSEA), the RMSEA 90% confidence interval (CI) and test of close fit (PCLOSE), and the standardized root mean square residual (SRMR). Values greater than .90 and .95 for CFI and TLI are considered indicative of acceptable and good model fit, respectively (Hu & Bentler, 1999; Marsh, Hau, & Wen, 2004). Values smaller than .08 and .05 for RMSEA, and smaller than .10 and .08 for SRMR, support acceptable and good model fit, respectively (Hu & Bentler, 1999). Concerning the RMSEA 90% CI, values below .05 or containing 0 for the lower bound and below.08 and .05 for the upper bound, provide, respectively, acceptable and good model fit (MacCallum, Browne, & Sugawara, 1996). PCLOSE is the one-sided test of the null hypothesis that RMSEA $\leq .05$, which indicates a close-fitting model; a probability greater than .05 should be expected.

Given the chi-square statistics, hypersensitivity to sample size and minor deviations from multivariate normality, applied CFA/SEM research typically focuses on sample-size independent goodness of fit indices (e.g., Marsh, Hau, & Grayson, 2005; Marsh et al., 2004), particularly the CFI, TLI, and RMSEA. However, as there is a growing amount of applications of ESEM (e.g., Ellison & Levy, 2012; Ford, Downey, Engelberg, Back, & Curtis, 2012; Marsh et al., 2010, 2011, 2009; Mattsson, 2012; Meleddu, Guicciardi, Scalas, & Fadda, 2012; Morin & Maïano, 2011; Myers, Chase, Pierce, & Martin, 2011; Samuel, Mullins-Sweatt, & Widiger, 2012; Sánchez-Carracedo et al., 2012), but none that fully investigated the adequacy of these traditional CFA fit indices and proposed cut-off scores, their relevance to ESEM is not clear. More research is warranted on the appropriateness of these indices for ESEM studies, in which the number of estimated parameters is substantially greater than the typical CFA study (in ESEM the number of factor loadings is the product of the number of items times the number of factors). This ESEM issue may lead to a more careful consideration of those fit indices that correct for parsimony, such as TLI and RMSEA (Marsh et al., 2009), because a more restrictive (and parsimonious) model may provide a better fit than a more complex model. Thus, the above mentioned proposed cut-off values should be considered as rough guidelines, not as "golden rules" (Marsh et al., 2005). Ultimately, when evaluating model goodness-of-fit, researchers are encouraged to use a synergic approach based on the integration of a variety of indices, including chi-square, fit indices, evaluations of parameter estimates in relations to theory, a priori predictions, previous research, professional judgment, and common sense (Marsh et al., 2009).

## RESULTS

### Preliminary Analyses

Descriptive statistics of UCLA LS3 items yielded skewness and kurtosis mean values equal to –.2699 (*SD* = .661; range = –1.079-2.074) and .1331 (*SD* = .3446; range = –.366-.791), respectively. Several skewness and kurtosis *z*-scores 2 *SD*s away from the mean indicated that moderate deviations from univariate normality (and thus from multivariate normality as well) were present in the data, yielding the adoption of maximum likelihood with robust standard error (MLR) estimator in the ESEM analyses.

Inter-item correlations analysis showed item moderate correlation values (Pearson's *r* range = –.072-.672, *M* = .254, *SD* = .136), with 35.26% of item correlation values above the minimum value of .30 (Kline, 1993).

### UCLA Factor Structure: ESEM Versus CFA

All analyses in the present study were conducted with Mplus 5.1 (Muthén & Muthén, 1998/2010), using the robust maximum likelihood estimator (MLR) to account for data non-normality and deal with ordinal variables.

The starting point for the present research was to explore UCLA LS3 Italian version latent structure. Although arguing that the ESEM approach might have provided better fit to the data, it was important to test the assumption of theoretical unidimensionality of the LS3 scale through a classic CFA model.

In Table 1 the goodness-of-fit statistics of CFA and ESEM models are presented. The CFA solution did not provide an acceptable fit to the data (CFI = .720; TLI = .687; RMSEA = .095). When faced with a poor fitting model, the typical approach is to use modification indices to free up sufficient parameters to achieve an adequate fit, thus pursuing the above-mentioned explorative use of CFA, which might lead to misleading, counterproductive, dubious, or even wrong, results.

Indeed, the CFA output presented a list of potential item residual covariance parameters to estimate, which in typical CFA are constrained to be zero, suggesting the presence of more complicated error structures, namely, correlated item uniquenesses.

The second step was to explore the internal structure of the UCLA LS3 Italian version, by estimating three different ESEM models hypothesizing two, three, or four latent factors. As previously described, one of the potential advantage of the ESEM approach is to combine EFA measurement part and standard SEM features, such as the possibility of regressing the latent factors on background variables, within a MIMIC approach. Hence, attachment ASQ subscales, self-esteem RSES and social-anxiety SIAS scores, were equated into the model as background variables affecting the latent factors of the UCLA LS3 Italian version. Structural coefficients were then estimated simultaneously with EFA measurement part, and subjected to the Geomin matrix rotation transformation as well.

The three-factor ESEM3_R2 model provided an adequate fit to the data (see Table 1). Considering goodness-of-fit indices that take into account model complexity, the TLI index presented a value of .889, which was just slightly under the cut-off value of .90, whereas the RMSEA index indicated a satisfactory fit of the model to the data, with a value of .048 (90% CI [.041, .055], PCLOSE = .673). The lowered TLI value was probably due to the average moderate size of inter-item correlation values (Pearson's $r$ $M$ = .254), as TLI depends on the average size of the correlations in the data (Miles & Shevlin, 2007).

Also the four-factor ESEM4 model showed to fit the data well (TLI = .871; RMSEA = .052; 90% CI [.044, .059]), but provided an overfactoring solution with only two items (item 19: "How often do you feel that there are people you can talk to?", and 20: "How often do you feel that there are people you can turn to?") loading in the fourth factor (ESEM4 factor 4 $R^2$= .214, $p$ = .032). Thus, despite the ESEM4 rather adequate model fit, the ESEM3_R2 three-factor solution appeared preferable.

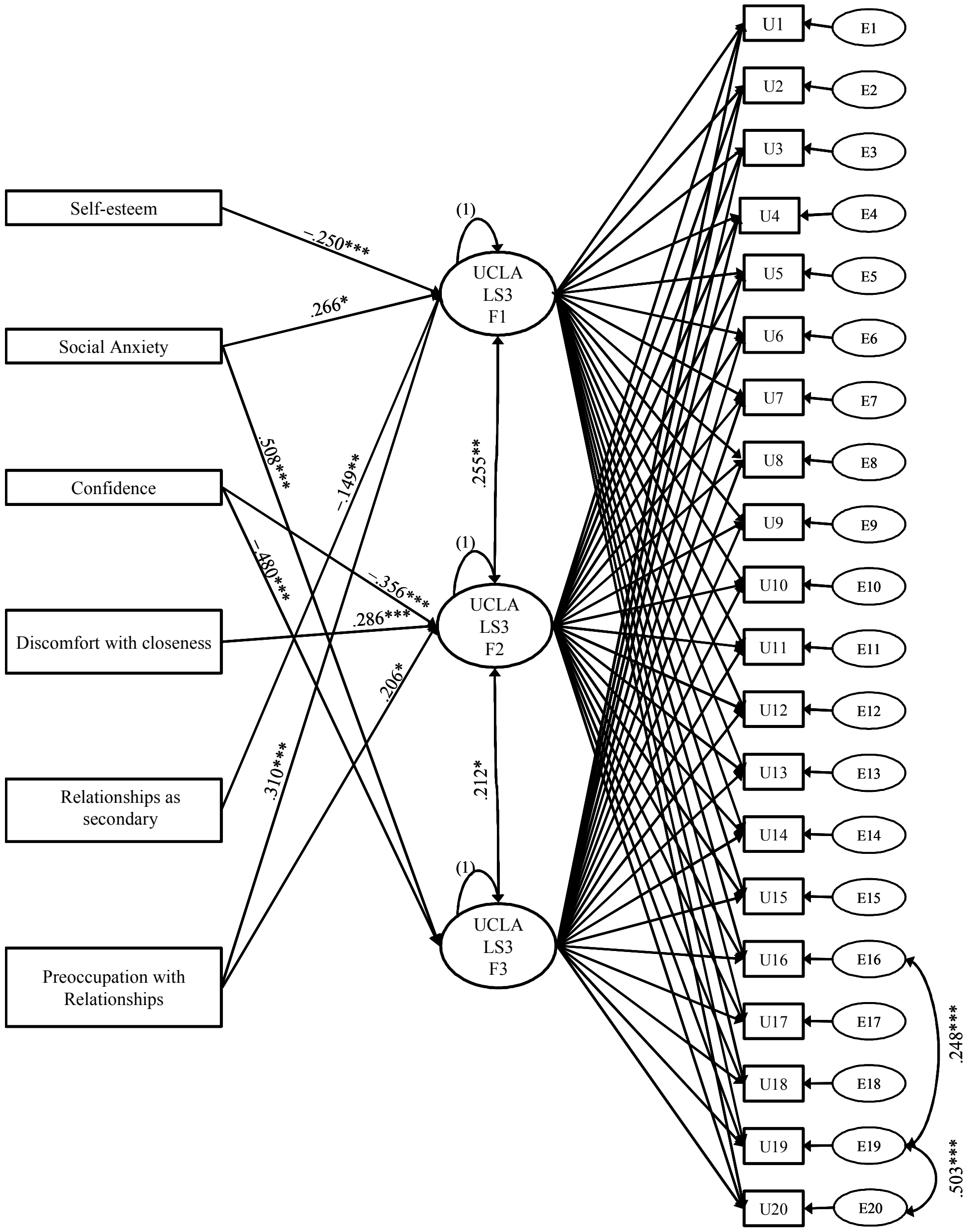
Figure 1 presents the path diagram of ESEM3_R2 Italian UCLA LS model. Only arrows for statistically significant parameter estimates were reported in the model path diagram. The Italian version of the UCLA LS3 loneliness scale showed three reliable latent factors ($R^2_{F1}$ = .474, $p$ < .001; $R^2_{F2}$ = .397, $p$ < .001; $R^2_{F3}$ = .564, $p$ < .001; Factor Determinacy Coefficient $(FDC)_{F1}$ = .924, $FDC_{F2}$ = .922, $FDC_{F3}$ = .886). The three factors resulted to be positively and moderately correlated ($\hat{\psi}_{12}$ = .255, $p$ = .008; $\hat{\psi}_{23}$ = .212, $p$ = .027). Only factor 1 and 3 turned out to be weakly correlated with a low covariance parameter estimate ($\hat{\psi}_{13}$ = .098, $p$ = .425), which was not reported in the model path diagram (Figure 1).

In particular, the measurement part of ESEM3_R2 model presented the additional specification of two item residual covariance parameter estimates: item 19 ("How often do you feel that there are people you can talk to?") and item 20 ("How often do you feel that there are people you can turn to?") ($\hat{\theta}_{1920}$ = .503, $p$ < .001), and item 19 and item 16 ("How often do you feel there are people who really understand you?") ($\hat{\theta}_{1619}$ = .248, $p$ < .001) residual covariance parameters were specified following ESEM4 model results and the hypothesis of the presence of an aggregate of items within Factor 2, linked by similar item wording and semantic contents.

TABLE 1
Summary of goodness-of-fit statistics for all models

| Model | $\chi^2$ | *df* | $\chi^2/df$ | *N* free parameters | CFI | TLI | RMSEA | RMSEA 90% CI | PCLOSE | SRMR | AIC | BIC* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CFA | 682.114 | 170 | 4.012 | 60 | .720 | .687 | .095 | .087-.112 | < .001 | .078 | 13234.350 | 13273.227 |
| ESEM2 | 757.191 | 277 | 2.734 | 93 | .791 | .751 | .072 | .066-.078 | < .001 | .057 | 27030.494 | 27090.753 |
| ESEM3 | 535.935 | 252 | 2.127 | 118 | .877 | .838 | .058 | .051-.065 | .030 | .041 | 26842.897 | 26919.355 |
| ESEM3_R | 465.750 | 251 | 1.856 | 119 | .907 | .877 | .050 | .043-.057 | .455 | .038 | 26778.582 | 26855.688 |
| ESEM3_R2 | 443.493 | 250 | 1.774 | 120 | .916 | .889 | .048 | .041-.055 | .673 | .038 | 26758.367 | 26836.120 |
| ESEM4 | 433.252 | 228 | 1.900 | 142 | .911 | .871 | .052 | .044-.059 | .345 | .034 | 26755.279 | 26847.287 |
| ESEM3_R2b | 429.523 | 233 | 1.843 | 117 | .915 | .887 | .050 | .043-.057 | .488 | .038 | 24977.667 | 25053.477 |
| ESEM3_R2c | 795.125 | 271 | 2.934 | 99 | .772 | .722 | .076 | .070-.082 | < .001 | .154 | 27091.732 | 27155.878 |

*Note*. CFI = comparative fit index; TLI = Tucker-Lewis Index; RMSEA = root mean square error of approximation; PCLOSE = test of close fit (probability RMSEA ≤ .05); SRMR = standardized root mean square residual; AIC = Akaike's information criterion; BIC = Bayesian information criterion.
*Sample-size adjusted BIC ($n^* = (n + 2) / 24$).




*$p < .05$. **$p < .01$. ***$p < .001$.

FIGURE 1
Path diagram of ESEM3_R2 model: UCLA LS3 Italian version three-factor structure, direct effects of adult attachment dimensions, self-esteem, and social anxiety.

In Table 2 the completely standardized UCLA LS3 ESEM item factor loading estimates are presented. Most of the estimated item loadings into the three latent factors are substantial (see Table 2, factor loadings highlighted in grey: *M* = .521, *SD* = .128), with systematically small and statistically non-significant non-target cross-loadings (*M* = .062, *SD* = .109). Only four items evidenced substantial factor cross-loadings exceptions (items 3, 10, 17, and 18), confirming the expected structure complexity greater than 1.

TABLE 2
Standardized Geomin-rotated item factor loading estimates (standard error)
of the ESEM3_R2 three-factor model for the UCLA LS3 Italian version

| Item | F1 | F2 | F3 |
|---|---|---|---|
| U1[a] | .001(.070) | .389(.100)*** | .245(.102)* |
| U2 | .629(.087)*** | –.096(.176) | –.026(.087) |
| U3 | **.440(.152)**** | **.398(.171)*** | –.042(.054) |
| U4 | .697(.143)*** | .193(.227) | –.059(.066) |
| U5[a] | .189(.116) | .402(.116)*** | .116(.096) |
| U6[a] | -.010(.075) | .527(.096)*** | .163(.121) |
| U7 | -.041(113) | .373(.083)*** | .027(.099) |
| U8 | .166(.135) | .354(.127)** | -.042(.089) |
| U9[a] | .015(.110) | –.009(.105) | .643(.078)*** |
| U10[a] | **–.448(.104)***** | .214(.189) | **.541(.153)***** |
| U11 | .652(.089)*** | .070(.188) | .098(.102) |
| U12 | .037(.105) | .386(.081)*** | –.026(.074) |
| U13 | .227(.193) | .636(.150)*** | –.157(.090) |
| U14 | .500(.119)*** | .249(.183) | .198(.092)* |
| U15[a] | .194(.102) | .072(.102) | .366(.091)*** |
| U16[a] | -.087(.101) | .672(.099)*** | .142(.113) |
| U17 | **.431(.162)**** | **–.359(.122)**** | **.544(.151)***** |
| U18 | **.331(.132)**** | **.408(.153)**** | .041(.085) |
| U19[a] | .038(.091) | .492(.076)*** | .046(.083) |
| U20[a] | .027(.119) | .617(.079)*** | –.001(.085) |

*Note*. The ESEM3_R2 was a MIMIC exploratory structural equation model with 3 UCLA LS3 Italian version latent factors regressed on covariates (see Table 1 for goodness-of-fit statistics). Here only the ESEM3_R2 EFA measurement part is presented. Substantial item loading parameter estimates highlighted in grey. Relevant factor cross-loadings highlighted in bold.
[a] Item score-reversed.
$^*p < .05$. $^{**}p < .01$. $^{***}p < .001$.

As previously described, in ESEM3_R2 linear paths from the personality independent variables to loneliness facets were simultaneously estimated. Adult attachment subscales of ASQ, RSES measure of self-esteem, and SIAS measure of social anxiety, were hypothesized to affect loneliness indicators through construct. In Figure 1 the structural relations among the Italian UCLA LS3 ESEM factors and the background variables entered into the ESEM3_R2 model are depicted.

Of the five ASQ subscales only the Need for Approval subscale did not significantly affect any loneliness factor, whereas the other four subscales affected the three UCLA LS3 factors either positively or negatively. Given the statistical non-significance of Need for Approval direct effects, the subscale was not reported in the path diagram (Figure 1). An ESEM model was performed without this ASQ subscale (ESEM3_R2b; see Table 1). This model presented a slightly worse fit to the data (CFI = .915; TLI = .887; RMSEA = .05; RMSEA 90% CI [.043, .057]; SRMR = .038), highlighting that, even if it did not affect loneliness dimensions at a statistically significant level, the Need for Approval subscale played a relevant role in the model, probably because part of the attachment anxiety second-order dimension, and thus strongly related to the other ASQ subscales.

Figure 1 shows that loneliness dimensions were substantively affected by the four personality variables considered in the present study. In particular, low adult attachment confidence, high levels of both anxious and avoidant attachment components, and social anxiety, resulted the main predictors of the three loneliness factors, whereas self-esteem negatively affected only the Italian UCLA LS3 first factor ($\hat{\beta} = -.250$, $p < .001$).

A 3-factor ESEM model in which the effects of all background variables were constrained to be zero, was also evaluated (ESEM3_R2c; see Table 1). This model clearly presented a worse fit (TLI = .722; RMSEA = .076; RMSEA 90% CI [.07, .082]; SRMR = .154) than ESEM3_R2, indicating the strong presence of personality independent variables effects on the definition of loneliness multidimensional construct.

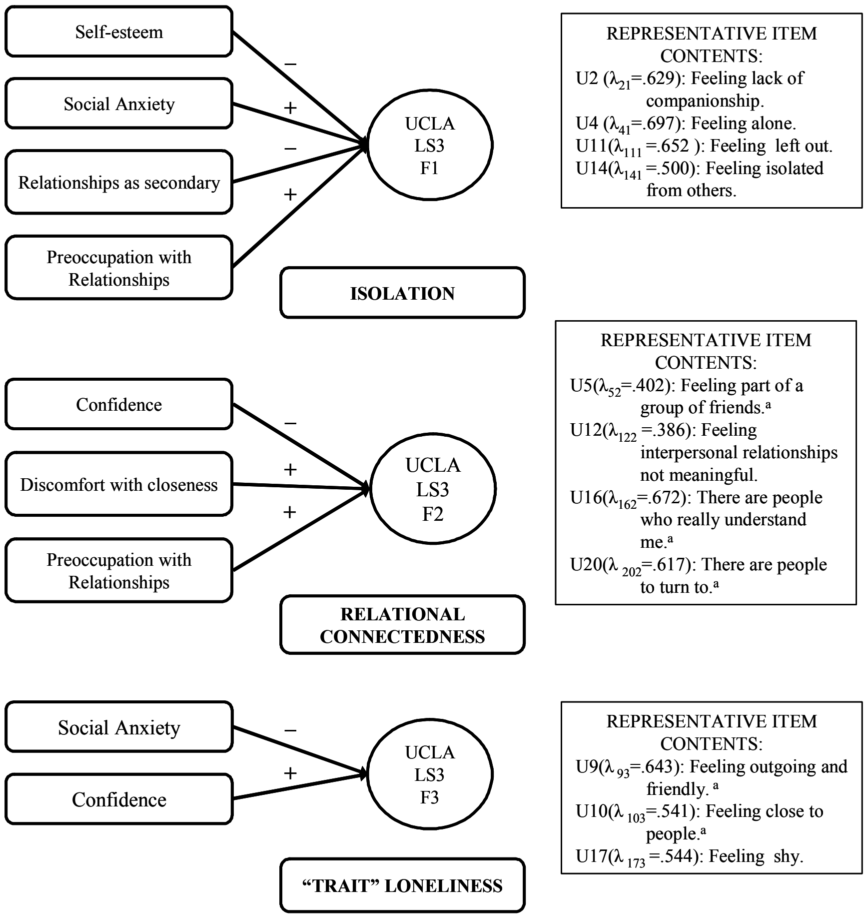
## Structure Interpretation

To examine the nature of the three-dimensional representation of loneliness construct, the substantial and highest item factor loadings in the three UCLA LS3 factors (items evidenced in grey in Table 2) were considered in tandem with the structural relations evidenced by the ESEM3_R2 model (see Figure 1), within a construct convergent validation perspective.

Figure 2 presents the interpretation of the three-faceted loneliness construct as measured by the UCLA LS3 Italian version; the psychological meaning of the three factors was based on both the measurement and structural part of ESEM_R2 model.

The items substantially loading into the first factor yielded feelings of aloneness, rejection, and withdrawal. This loneliness facet was labeled Isolation and corresponds to the experience of isolation in the affiliation relationships, or social loneliness, usually assumed to underlie loneliness general representation (e.g., Hawkley et al., 2005; Weiss, 1987). The Isolation factor was characterized by a general social dissatisfaction with oneself in the relationship domain, predicted by a low level of self-esteem ($\hat{\beta} = -.250$, $p < .001$) and high degree of preoccupation for and involvement in relationships, as shown by the incremental effects of social anxiety and anxious attachment components (high Preoccupation with Relationships, $\hat{\beta} = .310$, $p < .001$; low Relationships as Secondary, $\hat{\beta} = -.149$, $p = .025$).

For the second Italian UCLA LS3, the representative items acknowledged feelings of emotional closeness, support perception, and familiarity with others, denoting feelings of loneliness more related to the relational self, and therefore prompted the label Relational Connectedness (Hawkley et al., 2005). This factor describes the emotional component of loneliness due to unsatisfactory association with an intimate relationship (Weiss, 1987). Indeed, only attachment negative components predicted this factor, namely, low confidence ($\hat{\beta} = -.356$, $p < .001$) and high anxious and avoidant dimensions (Preoccupation with Relationships, $\hat{\beta} = .206$, $p = .017$; Discomfort with Closeness, $\hat{\beta} = .286$, $p <. 001$), confirming the link between loneliness and feeling the lack of meaningful relationships with others and unfulfillment of attachment needs.




[a] Item score-reversed.

FIGURE 2
Dimensional structure interpretation of the UCLA LS3 Italian version in relation to adult attachment, self-esteem, and social anxiety: External variables direct effects sign, factor labels, and representative item contents.

The third factor encompassed only a few UCLA LS3 items describing a general loneliness component related to more stable and "trait" individual characteristics, which may be considered as loneliness risk factors or individual personality characteristics that can predispose to a greater loneliness experience (e.g., Badoux-Levy, Robin, Lavarde, & Grygielski, 2004), such as feeling shy and not outgoing and friendly. This loneliness facet was labeled "Trait" Loneliness and describes how individuals perceive themselves (e.g., roles and social skills) within relationships, as frequency of social contact is not sufficient to explain the experience of loneliness. "Trait" Loneliness was significantly predicted by a low level of the attachment main component, namely, Confidence in both the Self and Others ($\hat{\beta} = -.480$, $p < .001$), which is quite a stable personality feature, and high levels of social interaction anxiety ($\hat{\beta} = .508$, $p < .001$), which tends to increase self-perceptions of not being socially competent.

## DISCUSSION

The present study was designed within a substantive-methodological synergy perspective. The substantive orientation was to evaluate the internal structure of the Italian version of the UCLA LS3 loneliness scale (Russell, 1996), which is the most widely used self-report measure for loneliness assessment and has not been adapted in the Italian context yet. In accomplishing the main objective of the present study, the usefulness and flexibility of a recent, evolving methodology pertaining to SEM framework, the ESEM approach (Asparouhov & Muthén, 2009), was demonstrated. ESEM method showed to be a promising and effective alternative in psychology research, when traditional CFA could fail or not be appropriate to investigate substantive issues.

To pursue the psychometric investigation of the Italian version of the UCLA LS3, an ESEM approach was selected in the present study, according to two main reasons: the lack of a priori hypotheses on the scale measurement structure suggested a rather explorative approach, and the ESEM possibility of modeling an EFA measurement model with rotations and a standard SEM model with covariates at the same time, provided a powerful tool to better define the scale internal structure and pursue the study of construct convergent validity.

From a methodological point of view, ESEM seemed a viable method to explore complex latent structures without any a priori theoretical hypotheses, thus avoiding an "exploratory" and data-driven use of traditional CFAs based on the extensive exploitation of modification indices to achieve a well-fitting model. The failure of CFA to correctly represent an instrument measurement structure often relies on the item factor loadings restrictions imposed by the model, which constrains non-target item loadings to be zero. The restrictions can lead then to inflated factor correlations and/or items misspecification, resulting in dubious, counterproductive, or even wrong, factor interpretation. ESEM method constitutes an integration of EFA approach with CFA/SEM features, providing a more flexible tool with all the advantages of traditional SEM. The consideration of measurement complexity greater than 1 (many factor cross-loadings) is more a rule than an exception in psychology research, with many psychology measurement instruments presenting a well-defined EFA factor structure, but failing in model fitting when subjected to CFA verification.

ESEM provided then the advantages of rigorous EFA with factor loadings matrix rotation transformation and the traditional possibilities of SEM, such as parameter estimates standard errors, goodness-of-fit statistics, modification indices, regression of latent factors on external variables to evaluate convergent and discriminant validity, multi-group test of full measurement invariance, latent growth modeling for longitudinal data, and the potential to impose more complicated error structures (e.g., correlated residuals or uniquenesses), which is straightforward for factor interpretation, because it allows to consider factor aggregates of items, or subfacets, in the specification of factor meaning.

Indeed, in the present study, items 20 and 16 uniqueness correlations with item 19 residual variance provided a more accurate understanding of the second Italian UCLA LS3 factor, namely, Relational Connectedness, which encompasses both emotional and cognitive facets of loneliness experience in relation to intimate relationships (e.g., Dussault et al., 2009; Hawkley et al., 2005; Weiss, 1987). The item residual covariances were specified following item similar wording ("How often do you feel there are people…") and contents (item 16, "understand you"; item 19, "talk to"; and item, 20 "turn to"), which are related to the cognitive evaluation of familiarity and support from other people and contribute to the relational social self domain of loneliness.

The ESEM model cross-loadings evaluation resulted in substantive item loadings into the three UCLA LS3 factors and systematically small and statistically not significant non-target loadings. This resulted in statistically significant moderate latent factors correlations, thus preserving a clear factor discrimination. Only a few item cross-loading exceptions were observed, underlying the presence of a measurement structure greater than 1, which is a common and expected phenomenon in psychology variables measurement, and the possibility that some items are not "pure" indicator of a latent factor but may represent different latent dimensions with different weights. For instance, item 17 ("How often do you feel shy?"), which loaded on each loneliness factor, presented the higher loading estimate in the "Trait" Loneliness factor, as shyness is a personality trait that can predispose individuals to experience a greater feeling of loneliness, but also in the Isolation factor, given that feeling shy is linked to and can exacerbate feelings of being left out and without friends. Also the Relational Connectedness factor showed to load on item 17, in the negative direction, suggesting that shyness is an aversive (or protecting?) characteristic for the more interior component of loneliness construct, namely, unsatisfied attachment and relational needs.

ESEM approach showed then the valuable benefit that cross-loadings consideration can yield when interpreting a construct latent structure, particularly with no a priori hypotheses on, or poor theoretical knowledge of, the measurement instrument.

Changing the point of view from methodological to substantive, the ESEM approach led to the simultaneous investigation of the psychological underpinnings of loneliness by exploring its association with self-esteem, attachment dimensions, and social anxiety. Indeed, the worse fit of the ESEM model with background variables effects constrained to be zero, evidenced the substantive role played by these personality and psychological features in determining loneliness components, confirming previous results on attachment, self-esteem, and social anxiety direct influence on loneliness experience mechanisms (e.g., DiTommaso, Brannen-McNulty, Ross, & Burgess, 2003). Noteworthy is the strong substantial influence exerted by attachment dimensions on loneliness factors, in particular the incremental effect of anxious component of Preoccupation with Relationships, which worked in tandem with social anxiety, and, to a lesser extent, avoidant component of Discomfort with Closeness. This means that individuals with low attachment confidence and anxious and dismissing orientations, are more at risk of greater feelings of loneliness, related to both the concrete isolation perception and the emotional experience of unfulfillment of relational needs.

The three UCLA LS 3 loneliness factors highlighted are then rather in line with the three-factor structures previously identified (Durak & Senol-Durak, 2010; Dussault et al., 2009; Hawkley et al., 2005) confirming the multidimensional nature of the loneliness construct (Weiss, 1987). Of interest are the moderate correlations between the latent factors, suggesting that they are clearly differentiated from each other and work together in characterizing the loneliness construct. Fulfilling the needs of one facet does not automatically satisfy the needs of the other, and that consideration of all loneliness dimensions is necessary to evaluate the degree to which an individual is experiencing loneliness. In particular, the low covariance estimate between the Isolation and "Trait" Loneliness factors suggests a possible independency between the concrete perception of being alone and isolated from others and the trait predisposition to loneliness feelings, which may not necessarily imply a real feeling of loneliness. Further, the Isolation facet of loneliness may not be directly associated with the "Trait" Loneliness, but rather the link may be mediated by the emotions and feelings related to the individual's unfilled relational needs, namely the Relation Connectedness facet. Nevertheless, this theoretical hypothesis should be further explored and tested.

Some limitations must be taken into account as starting points for future research. Considering the nature of the sample used in the present study, further investigation on the Italian version of the UCLA LS3 is warranted, particularly considering a wider age range to explore the stability of the loneliness dimension throughout the lifespan, which is also possible within a latent growth ESEM modeling approach.

The limited results generalization may also be due to the moderate sample size, which did not allow to consider independent individual variables that can affect item functioning, such as gender. Unfortunately, only about 32% of participants was male, thus the pursuit of a rigorous test of instrument measurement and factorial invariance was not possible. ESEM approach does provide the possibility of performing multi-group test of configural, scalar, and strict measurement invariance, and differential item functioning investigation as traditional CFA/SEM approach. Future investigation should afford then the further investigation of Italian UCLA LS3 psychometric properties within an ESEM approach, but not exclusively, through a systematic testing of a models taxonomy positing an increasing scale measurement and factorial invariance (e.g., Marsh et al., 2010, 2011, 2009). Moreover, the ESEM possibility to simultaneously define a scale internal structure and consider other personality and individual independent variables within a concurrent and discriminant validity perspective, with the application of an ESEM MIMIC approach (e.g., Marsh et al., 2009), may extend the Italian UCLA LS3 refinement and deepen the understanding of the psychological mechanisms underlying the loneliness experience.

## REFERENCES

Asparouhov, T., & Muthén, B. (2009). Exploratory Structural Equation Modeling. *Structural Equation Modeling*, *16*, 397-438. doi:10.1080/10705510903008204

Azimeh, S. (2011). Social-emotional loneliness and life satisfaction. *Procedia – Social and Behavioral Sciences*, *29*, 292.

Badoux-Levy, A., Robin, M., Lavarde, A. M., & Grygielski, V. (2004). Psychological and social factors predictive of loneliness: A cognitive and behavioral approach. *Encephale*, *30*(1), 16-23. doi:ENC-2-2004-30-1-0013-7006-101019-ART2

Bovornusvakool, W., Vodanovich, S. J., Ariyabuddhiphongsb, K., & Ngamake, S. T. (2012). Examining the antecedents and consequences of workaholism. *The Psychologist-Manager Journal*, *15*(1), 56-70. doi:10.1080/10887156.2012.649994

Browne, M. W. (2001). An overview of analytic rotation in exploratory factor analysis. *Multivariate Behavioral Research*, *36*, 111-150. doi:10.1207/S15327906MBR3601_05

Cacioppo, J. T., Hawkley, L. C., & Thisted, R. A. (2010). Perceived social isolation makes me sad: Five year cross-lagged analyses of loneliness and depressive symptomatology in the Chicago health, aging, and social relations study. *Psychology and Aging*, *25*(2), 453-463. doi:10.1037/a0017216

Cacioppo, J. T., Hughes, M. E., Waite, L. J., Hawkley, L. C., & Thisted, R. A. (2006). Loneliness as a specific risk factor for depressive symptoms: Cross-sectional and longitudinal analyses. *Psychology and Aging*, *21*(1), 140-151. doi:10.1037/0882-7974.21.1.140

DiTommaso, E., Brannen-McNulty, C., Ross, L., & Burgess, M. (2003). Attachment styles, social skills and loneliness in young adults. *Personality and Individual Differences*, *35*, 303-312. doi: 10.1016/S0191-8869(02)00190-3

Durak, M., & Senol-Durak, E. (2010). Psychometric qualities of the UCLA Loneliness Scale-version 3 as applied in a Turkish culture. *Educational Gerontology*, *36*, 988-1007. doi:10.1080/03601271003756628

Dussault, M., Fernet, C., Austin, S., & Leroux, M. (2009). Revisiting the factorial validity of the revised UCLA Loneliness Scale: A test of competing models in a sample of teachers. *Psychological Reports*, *105*, 849-856. doi:10.2466/pr0.105.3.849-856

Ellison, W. D. & Levy, K. N. (2012). Factor structure of the primary scales of the Inventory of Personality Organization in a nonclinical sample using Exploratory Structural Equation Modeling. *Psychological Assessment*, *24*(2), 503-517. doi:10.1037/a0026264

Erdil, O., & Ertosun, O. G. (2011). The relationship between social climate and loneliness in the workplace and effects on employee well-being. *Procedia — Social and Behavioral Science*, *24*, 505-525. doi:10.1016/j.sbspro.2011.09.091

Erickson, J., & Johnson, G. M. (2001). Internet use and psychological wellness during late adulthood life satisfaction. *Canadian Journal on Aging*, *30*(2), 197-209. doi:10.1017/S0714980811000109

Feeney, J. A., Noller, P., & Hanrahan, M. (1994). Assessing adult attachment. In M. B. Sperling & W. Berman (Eds.), *Attachment in adults: Clinical and developmental perspectives* (pp. 128-152). New York, NY: Guilford Press.

Ford, D. W., Downey, L., Engelberg, R., Back, A. L., & Curtis, J. R. (2012). Discussing religion and spirituality is an advanced communication skill: An Exploratory Structural Equation Model of physician trainee self-rating. *Journal of Palliative Medicine*, *15*(1), 63-70.

Fossati, A., Feeney, J. A., Donati, D., Donini, M., Novella, L., Bagnato, M., ... Maffei, C. (2003). On the dimensionality of the Attachment Style Questionnaire in Italian clinical and nonclinical participants. *Journal of Social and Personal Relationships*, *20*(1), 55-79. doi:10.1177/02654075030201003

Goodwin, R., Cook, O., Yung, Y. (2001). Loneliness and life satisfaction among three cultural groups. *Personal Relationships*, *8*(2), 225-230. doi:10.1111/j.1475-6811.2001.tb00037.x

Hartshorne, T.S. (1993). Psychometric properties and confirmatory factor analysis of the UCLA Loneliness Scale. *Journal of Personality Assessment, 61(1)*, 182-195. doi:10.1207/s15327752jpa6101_14

Hawkley, L. C., Browne, M. W., & Cacioppo, J. T. (2005). How can I connect with thee? Let me count the ways. *Psychological Science*, *16*(10), 798-804. doi:10.1111/j.1467-9280.2005.01617.x

Hawkley, L. C., Thisted, R. A., & Cacioppo, J. T. (2009). Loneliness predicts reduced physical activity: Cross-sectional & longitudinal analyses. *Health Psychology*, *28*(3), 354-363. doi:10.1037/a0014400

Hawkley, L.C., Burleson, M. H., Berntson, G. G., & Cacioppo, J. T. (2003). Loneliness in everyday life: Cardiovascular activity, psychosocial context, and health behaviors. *Journal of Personality and Social Psychology*, *85*(1), 105-20. doi:10.1037/0022-3514.85.1.105

Hawkley, L. C., Thisted, R. A., & Cacioppo, J. T. (2009). Loneliness predicts reduced physical activity: Cross-sectional & longitudinal analyses. Health Psychology, 28(3), 354-363. doi:10.1037/a0014400

Heinrich, L. M., & Gullone, E. (2006). The clinical significance of loneliness: A literature review. *Clinical Psychology Review*, *26*, 695-718. doi:10.1016/j.cpr.2006.04.002

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

Jennrich, R. I. (2006). Rotation to simple loadings using component loss functions: The oblique case. *Psychometrika*, *71*, 173-191. doi:10.1007/s11336-003-1136-B

Kim, J., LaRose, R., & Peng, W. (2009). Loneliness as the cause and the effect of problematic Internet use: The relationship between Internet use and psychological well-being. *CyberPsychology & Behavior*, *12*(4), 451-455. doi:10.1089=cpb.2008.0327

Kline, P. (1993). *The handbook of psychological testing*. London: Routledge.

Lam, L. W., Lau, D. C. (2012). Feeling lonely at work: Investigating the consequences of unsatisfactory workplace relationships. *International Journal of Human Resource Management*, *23*(20), 4265-4282. doi:10.1080/09585192.2012.665070

Lasgaard, M. (2007). Reliability and validity of the Danish version of the UCLA Loneliness Scale. *Personality and Individual Differences*, *42*, 1359-1366. doi:10.1016/j.paid.2006.10.013

MacCallum, R. C., Browne, M. W., & Sugawara, H. M. (1996). Power analysis and determination of sample size for covariance structure modeling. *Psychological Methods*, *1*, 130-149. doi:10.1037/1082-989X.1.2.130

Marsh, H. W., & Hau, K. T. (2007). Application of latent variable models in educational psychology: The need for methodological-substantive synergies. *Contemporary Educational Psychology*, *32*, 152-170. doi:10.1016/j.cedpsych.2006.10.008

Marsh, H. W., Hau, K. T., & Grayson, D. (2005). Goodness of fit evaluation in structural equation modeling. In A. Maydeu-Olivares & J. McArdle (Eds.), *Contemporary Psychometrics. A Festschrift to Roderick P. McDonald* (pp. 225-340). Hillsdale, NJ: Erlbaum.

Marsh, H. W., Hau, K. T., & Wen, X. (2004). In search of golden rules: Comment on hypothesis testing approaches to setting cutoff values for fit indices and dangers in overgeneralizing Hu and Bentler's (1999) findings. *Structural Equation Modeling*, *11*, 320-341. doi:10.1207/s15328007sem1103_2

Marsh, H. W., Lüdtke, O., Muthén, B. O., Asparouhov, T., Morin, A. J. S, Trautwein, U., & Nagengast, B. (2010). A new look at the Big Five factor structure through Exploratory Structural Equation Modeling. *Psychological Assessment*, *22*(3), 471-491. doi:10.1037/a0019227

Marsh, H. W., Nagengast, B., Morin, A. J. S., Parada, R. H., Craven, R. G., & Hamilton, L. R. (2011). Construct validity and multidimensional structure of bullying and victimization: An application of Exploratory Structure Equation Modeling. *Journal of Educational Psychology*, *103*(3), 701-732. doi:10.1037/a0024122

Marsh, H. W., Muthén, B., Asparouhov, T., Lüdtke, O., Robitzsch, A., Morin, A. J. S., & Trautwein, U. (2009). Exploratory Structural Equation Modeling, integrating CFA and EFA: Application to students' evaluations of university teaching. *Structural Equation Modeling*, *16*, 439-476. doi:10.1080/10705510903008220

Mattick, R. P., & Clarke, C., (1998). Development and validation of measures of social phobia scrutiny fear and social interaction anxiety. *Behavior Research & Therapy*, *36*, 455-470. doi:10.1016/S0005-7967(97)10031-6

Mattsson, M. (2012). Investigating the factorial invariance of the 28-item DBQ across genders and age groups: An Exploratory Structural Equation Modeling study. *Accident Analysis and Prevention*, *48*, 379-396. doi:10.1016/j.aap.2012.02.009. ISSN: 0001-4575.

McWirther, B. T. (1990). Factor analysis of the revised UCLA loneliness scale. *Current Psychology: Research & Reviews*, *9*, 56-68. doi:10.1007/BF02686768

Meleddu, M., Guicciardi, M., Scalas, F., & Fadda, D. (2012). Validation of an Italian version of the Oxford Happiness Inventory in Adolescence. *Journal of Personality Assessment*, *94*(2), 175-185. doi: 10.1080/00223891.2011.645931

Mellor, A., Stokes, M., Firth, L., Hayashi, Y., & Cummins, R. (2008). Need for belonging, relationship satisfaction, loneliness, and life satisfaction. *Personality and Individual Differences*, *45*(3), 213-218. doi:10.1016/j.paid.2008.03.020

Miles, J., & Shevlin, M. (2007). A time and a place for incremental fit indices. *Personality and Individual Differences*, *42*, 869-874. doi:10.1016/j.paid.2006.09.022

Morin, A. J. S., & Maïano, C. (2011). Cross-validation of the short form of the physical self-inventory (PSI-S) using exploratory structure equation modeling (ESEM). *Psychology of Sport and Exercise*, *12*, 540-554. doi:10.1016/j.psychsport.2011.04.003

Muthén, L. K., & Muthén, B. O. (2010). *Mplus user's guide* (6th ed.). Los Angeles, CA: Author. (Original work published 1998).

Myers, N. D., Chase, M. A., Pierce, S. W., & Martin, E. (2011). Coaching efficacy and Exploratory Structural Equation Modeling: A substantive-methodological synergy. *Journal of Sport & Exercise Psychology*, *33*, 779-806.

Ozcelik, H., & Barsade, S. (2011). Work loneliness and employee performance. *Proceedings of the 71st Annual Meeting of the Academy of Management,* San Antonio, Texas, 1.

Pretoirus, T. B. (1993). The metric equivalence of the UCLA Loneliness Scale for a sample of South African students. *Educational and Psychosocial Measurement*, *53*(1), 233-239. doi:10.1177/0013164493053001026

Prezza, N., Trombaccia, F. R., & Armento, L. (1997). La scala dell'autostima di Rosenberg. Traduzione e validazione italiana [Rosenberg's self-esteem scale. Italian translation and validation]. *Bollettino di Psicologia Applicata*, *223*, 35-44.

Rosenberg, M. (1965). *Society and the adolescent self-image*. Princeton, NJ: Princeton University Press.

Russell, D. W. (1996). UCLA Loneliness Scale (Version 3): Reliability, validity, and factor structure. *Journal of Personality Assessment*, *66*(1), 20-40. doi:10.1207/s15327752jpa6601_2

Russell, D. W., Peplau, L. A, & Cutrona, C. E. (1980). The revised UCLA Loneliness Scale: Concurrent and discriminant validity evidence. *Journal of Personality and Social Psychology*, *39*(3), 472-480. doi:10.1037/0022-3514.39.3.472

Sacchi, C., & Richaud de Minzi, M. C. (1997). UCLA's revised scale of loneliness: An Argentinian adaptation. *Revista Argentina de Clínica Psicológica*, *6*(1), 43-53.

Samuel, D. B., Mullins-Sweatt, S. N., & Widiger, T. A. (2012). An investigation of the factor structure and convergent and discriminant validity of the five-factor model rating form. *Assessment, epub ahead of print.* doi:10.1177/ 1073191112455455

Sánchez-Carracedo, D., Barrada, J. R., López-Guimerà, G., Fauquet, J., Almenara, C. A., & Trepat, E. (2012). Analysis of the factor structure of the Sociocultural Attitudes Towards Appearance Questionnaire (SATAQ-3) in Spanish secondary-school students through exploratory structural equation modeling. *Body Image*, *9*, 163-171. doi:10.1016/j.bodyim.2011.10.002

Segrina, C., & Domschkea, T. (2011). Social support, loneliness, recuperative processes, and their direct and indirect effects on health. *Health Communication*, *26*(3), 221-232. doi:10.1080/10410236.2010.546771

Sica, C., Musoni, I., Chiri, L. R., Bisi, B., Lolli, V., & Sighinolfi, C. (2007). Social Phobia Scale (SPS) e Interaction Anxiety Scale (SIAS): traduzione e adattamento italiano. [Social Phobia Scale (SPS) and Interaction Anxiety Scale (SIAS): Italian translation and adaptation] *Bollettino di Psicologia Applicata*, *252*, 59-71.

van de Vijver, F. J. R., & Hambleton, R. K. (1996). Translating tests: Some practical guidelines. *European Psychologist*, *1*, 89-99. doi:10.1027/1016-9040.1.2.89

Weiss, R. S. (1987). Reflections on the present state of loneliness research. *Journal of Social Behavior and Personality*, *2*, 1-16.

Wu, C., & Yao, G. (2008). Psychometric analysis of the short-form UCLA Loneliness Scale (ULS-8) in Taiwanese undergraduate students. *Personality and Individual Differences*, *44*, 1762-1771. doi:10.1016/j.paid.2008.02.003