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GENDER INVARIANCE IN THE LOVE ATTITUDES SCALE BASED ON LEE'S COLOR THEORY OF LOVE

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To investigate the extent that Lee's (1977) six Colors or Styles of Love — Eros, Ludus, Storge, Pragma, Mania, and Agape — were gender invariant, a sample of 364 men and 580 women (currently in romantic relationships) were selected from a university population. Confirmatory factor analysis could not reproduce the six-factor solution for either male or female sub-sample; subsequent exploratory analyses showed with some item re-arrangement, male and female data conformed to a reduced (and not entirely identical) six-factor solution where several constituent items were not included or were reassigned. Implications for measurement via this scale are discussed, as are directions for future research.

Key words: Love; Measurement; Invariance; Gender; Psychometrics.

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Webster's lyrics to "Love is a Many Splendored Thing" shed useful light on the multiplicity of love, suggesting the concept is best captured multi-dimensionally (like the many facets of a jewel) rather than as a single entity (see Aron & Westbay, 1996; Davis & Latty-Mann, 1987; Gana, Saada, & Untas, 2013; Hendrick, Hendrick, Foote, & Slapion-Foote, 1984; Lin & Huddleston-Casas, 2005; Singer, 1984; Sternberg, 1987). Since researchers began the empirical study of interpersonal relationships, it became clear that any hope of measuring love empirically must involve multiple dimensions. Though interpersonal attraction theories by both Sternberg (1986) and Berscheid and Walster (1974) suggested multiple varieties of love, we explore presently the feasibility of utilizing Lee's (1977) six-component love scale across gender. We will describe each component, and explore their psychometric profile. After reviewing the literature for mean differences by gender, we will advance the hypothesis that mean differences may have resulted from male and female respondents' unique interpretation of items, which violates the general assumption of scale invariance.

SIX STYLES OR COLORS OF LOVE

Lee's (1977) comprehensive model of love delineated six styles or colors: 1) *Eros*, from the Greek root for "erotic," constitutes sexual passion (sample item: "My partner and I have the

right physical 'chemistry' between us") and is primarily based on physical attraction and sexual pleasure (Lord, 1997). Love is considered life's most important activity for the erotic lover, so daily contact is desired, and there remains a strong commitment to one's partner (Hendrick & Hendrick, 1992). 2) *Ludus* or game-playing may possibly involve other relationships unknown to one partner ("I try to keep my partner a little uncertain about my commitment to him/her"). Ludic individuals treat love like a contest or sport, played best with several partners in many simultaneous relationships (Lord, 1997). They enjoy the passion and intimacy of the relationship, but have little commitment (Dion & Dion, 1973, 1993), and tend to be somewhat manipulative (Hendrick & Hendrick, 1992). 3) *Storge*: lovers enjoy the intimate elements of a relationship ("I expect to always be friends with my partner"), and believe love is indistinguishable from lasting friendship. They are considered honest, loyal, and mature (Taraban & Hendrick, 1995). Storgic love is then solid and down-to-earth, and presumably enduring (Hendrick & Hendrick, 1992). 4) *Pragma*'s practical components of a relationship (whether monetary, social, or child-based; "An important factor in choosing my partner was whether or not s/he would be a good parent") cast a rational light on the desired attributes of the lover, and use criteria-matching markers in their search for a partner (Hendrick & Hendrick, 1992). They treat love like a legally binding contract, and often act very cool and detached (Lord, 1997). 5) *Mania* describes the obsession, possessiveness, or jealousy witnessed in some relationships ("When my partner does not pay attention to me, I feel sick all over"). Manic lovers want complete union with their partner, and are miserable if they do not get all their lover's attention (Taraban & Hendrick, 1995). The manic lover yearns for love, yet expects it to be painful, and experiences anxiety about the future (Hendrick & Hendrick, 1992). 6) Finally, *Agape* or all-giving selfless love puts one's partner's needs above one's own ("I would endure all things for the sake of my partner"). Agapic lovers tend to be altruistic; they sacrifice for the sake of love and are committed, caring, and giving (Taraban & Hendrick, 1995).

According to Lee, three of the six styles of love are primary (Eros, Ludus, and Storge) and three are secondary (Mania, Pragma, and Agape), representing the qualitative transformations of the base primary elements. The six styles vary as per emotional intensity: Eros and Mania are high in emotion, Agape is average, and each of Ludus, Storge, and Pragma are low. The variability suggests they might even reflect temperamental facets of a person (Hendrick & Hendrick, 1986). Overall, Lee's typology is exceedingly rich theoretically because of its few assumptions and grounding in research (Hendrick & Hendrick, 1989). For instance, Storge reflects Walster and Walster's (1978) notion of companionate love, Pragma is discussed in social exchange theory (Cummins, 1996), and Agape exemplifies Clark and Mills (1979) component of communal love.

Gender Differences in Love

Variations in sociocultural background and differential display rules should produce group differences in the six styles of love. Indeed, research has consistently found men to utilize the Ludic style more often than women, whereas women are more likely to exhibit each of the Manic, Pragmatic, and Storgic love styles (Hendrick & Hendrick, 1986, 1988; Hendrick et al., 1984). Thus, men may engage in more game-playing in their dyadic relationships, as opposed to women's possessive, logical, and companionate styles. Men and women in the United States have been found to more evenly utilize the Agapic and Erotic love styles (Hendrick & Hendrick, 1986); however, Davies (1996) — using a British sample — found males were more likely to

display both Agape and Eros love styles; still others found greater endorsement of only Agape by males (Büyükşahin & Hovardaoğlu, 2004; Lin & Huddleston-Casas, 2005; Risavy, 1996). Investigations into the quality of heterosexual relationships report women to be most satisfied with men who were erotic and altruistic (Morrow, Clark, & Brock, 1995); and least satisfied with men who were ludic and pragmatic. Men similarly felt most satisfied in relationships with women who were erotic, and least satisfied with women who were pragmatic (Lord, 1997). Ultimately, both men and women were most satisfied with relationships involving Eros, Storge, and Agape (Risavy, 1996), or Eros alone (Gana et al., 2013; Masuda, 2003).

Several theorists propose that gender differences in love attitudes parallel real attitude differences toward sexuality (e.g., Ferrell, Tolone, & Walsh, 1977; Medora & Woodward, 1982). In support, research shows that men and women differ in their attitudes toward sexual permissiveness — men scoring significantly higher (Hendrick & Hendrick, 1988; Hendrick, Hendrick, Slapion-Foote, & Foote, 1985). This finding is consistent, with higher levels of the ludic love reported among men, who are more likely to engage in casual sex (Hendrick & Hendrick, 1992). On the other hand, women have traditionally been socialized to be conservative in their sexual attitudes, seeking one love partner and long-term potential provider (Hendrick & Hendrick, 1986). This may well account for women's higher levels of possessive, logical, and companionate love styles. Gender differences in love styles can also predict the extent to which individuals in a romantic dyad will silence their personal doubts, fears, or concerns of the relationship — referred to as self-silencing (Collins, Cramer, & Singleton-Jackson, 2005) or elicit disclosure in others (Hendrick & Hendrick, 1987).

Whereas gender has been the key grouping variable by which respondents have been compared, differences in love style have been identified by other important dimensions, including age (Risavy, 1996) and time (Hendrick & Hendrick, 1988, 2003). For instance, couples were more likely to experience Mania at the beginning of the relationship (Büyükşahin & Hovardaoğlu, 2004). Education level (Lin & Huddleston-Casas, 2005), ethnicity (Hendrick & Hendrick, 1989; Neto, 2007), and television preference (Hetsroni, 2012) have also been related to love styles. Aside from grouping variables, love styles are predictable on the basis of several personality variables, including extraversion, self-esteem, impulsivity, and sensation-seeking (e.g., Davies, 1996; Hendrick & Hendrick, 1987; Mallandain & Davies, 1994; Richardson, Medvin, & Hammock, 1988). Thus, inherent individual differences may contribute to the development of specific love styles, but these may also be affected by various socialization practices.

SCALE PSYCHOMETRICS AND INVARIANCE

The presence of mean differences by gender, age, and personality prompts the subsequent question concerning their source: are these legitimate differences or rather are they correlates (as generated by social expectations, display rules, genetic differences, unique socialization histories, etc.), or could they be an artifact of the instrument (used to measure love) that is interpreted uniquely by men and by women? We pursue the latter argument from the perspective of a key psychometric assumption in test administration, namely that of scale invariance.

Conclusions drawn from comparative analyses may not be valid if the measures do not share the same meaning across groups. In other words, conclusions regarding mean differences between groups on a given measure cannot easily be interpreted if the underlying construct is in-

terpreted uniquely across, for instance, men and women (Vandenberg & Lance, 2000). In order to make meaningful interpretations of group differences, one must first establish the assumption of scale invariance — this is not evaluated using mean differences, but rather by examining the pattern of variation across groups. This allows for a more conceptual-level comparison that should not be sensitive to group mean score differences (Chen, 2007; Slof-Op 't Landt et al., 2009; Vandenberg & Lance, 2000).

The aforementioned styles of love theory was the foundation for Hendrick and Hendrick (1986, 1988, 1989, 1992) to launch a research program (a) to develop a detailed account about Lee's (1973, 1977, 1988) taxonomy of love styles, (b) to construct reliable scales to measure them, and (c) to study the relation between love and sex attitudes. Based on Lee's (1977) claim that the love styles can exist on multiple levels of meaning, such as attitudes or behavior, Hendrick and Hendrick (1986) utilized factor-analytic techniques to develop an instrument to reliably assess Lee's taxonomy — the Love Attitudes Scale (Hendrick & Hendrick, 1986). Both high re-test reliabilities (rs > .60 for all scales), good scale internal consistencies (αs > .70) for all but one of the subscales (Storge α = .62) were observed within samples of predominately unmarried college students from somewhat ethnically diverse (5.3% Black, 50.4% White-non-Hispanic, 29.0% White-Hispanic, 7.7% Oriental, and 7.6% Other), mostly Catholic or Protestant, and chiefly middle-class backgrounds (Hendrick & Hendrick, 1986, 1989). These same studies found support for content validity, whereby factor analysis uncovered the hypothesized six-factor solution (Murthy, Rotzien, & Vacha-Haase, 1996); more diverse samples, involving several hundred single Portuguese students (Neto, 2007) and unmarried Israeli students (Hetsroni, 2012) found comparable results.

To date, no study has yet to evaluate whether the psychometric properties of the Love Attitudes Scale is invariant by gender — the principal variable of empirical interest. It is noteworthy that the issues of gender invariance has been identified as problematic in other similar instruments. Specifically, the Tetrangular Model (Yela, 2006) was found to be gender invariant in a sample of 200 Brazilian undergraduate students who were mostly single (M_{age} = 25; Gouveia, de Carvalho, dos Santos, & de Almeida, 2013). Additionally, questions about relationship satisfaction in the RELATional Evaluation survey (RELATE) were uncovered to fit the model using a sample of over 1,700 married, heterosexual Caucasian couples who had attended some college; however, it supported claims that the scale was not gender invariant (Walker, 2009). For the present study, the Love Attitudes Scale shares similar concerns because there is at least the suggestion that an instrument fails to be invariant when the psychometric properties are not equivalent across groups. Therefore, any scale's gender invariance needs to be evaluated before claims about gender differences can be considered legitimately valid.

THE PRESENT STUDY

As an evaluation of gender invariance, we conducted the present study to evaluate the consistency of Lee's (1977) love styles across men and women using the Love Attitudes Scale. Following a confirmatory factor analysis with prescribed six-factor-item membership, we examined factor structure via exploratory methods to reveal on what items males and females differed, and whether or not there were significant differences in scores for each style of love.

METHOD

Participants, Measures, and Procedure

Participants in the study (recruited through a departmental participant pool) were 364 male and 580 female students from a mid-sized Canadian university who elected to participate for partial course credit. Inclusion criteria required all participants to be involved in romantic relationships (all unique) at the time of the study. Mean age was 21.69 years (SD = 4.11), and not significantly different by gender ($p > .05$). Approximately 92% of the sample was single (but in a relationship), whereas 4.3% were married, and 3.7% were common-law. Furthermore, 78% were Caucasian, 5% African, 7% Asian, 1% First Nations,[1] and 9% listed as "other."

In groups of approximately 100, participants completed Hendrick and Hendrick's (1986) 42-item Love Attitudes Scale,[2] comprised of six 7-item subscales: Eros (sex and passion), Ludus (game-playing), Storge (friendship and intimacy), Pragma (practical ventures), Mania (obsession and possessiveness), and Agape (selfless love). Responses ranged from 1 (*strongly disagree*) to 5 (*strongly agree*). Upon completion, participants were debriefed as to the purpose of the study.

Data Analysis

Factor structure of the Love Attitudes Scale was evaluated using AMOS 5. Confirmatory factor analyses of the six-factor model (Hendrick & Hendrick, 1986) were performed using the total sample data set (N = 944), later separated by male and female subsamples. Whereas there were no missing data within the Love Scale, five students elected not to include their gender (and were excluded from the analyses). When evaluating the extent to which a given model is an adequate representation of the item intercorrelations, several fit indices can be utilized; many can account for the current large sample size. It is imperative to include other fit indices beyond the goodness-of-fit chi-square test given its sensitivity to large sample sizes (Hu & Bentler, 1999). As such, good model fit is evident when the root mean square error of approximation (RMSEA; a measure of mis-fit) conventionally is equal to or less than .05 (Browne & Cudeck, 1993). Acceptable model fit is indicated by index values above .95 for each of the comparative fit index (CFI), normed fit index (NFI), and adjusted goodness of fit index (AGFI) (Baumgartner & Hombur, 1996; Hu & Bentler, 1999).

RESULTS

The matrix of correlations among the six love subscales, along with descriptive statistics such as means, standard deviations, and alpha reliability coefficients, can be found in Table 1. For both male and female respondents, the six subscales demonstrated adequate internal consistency (alphas $\geq$ .64). Using a significance level of .05, two-tailed t-tests were conducted to assess gender differences in each subscale. Whereas results showed no difference in Pragma ($p > .05$), males did outscore females on both Ludus and Agape, but females outscored males on each of Eros, Storge, and Mania (ps < .05). The Williams-Hotelling test (Zou, 2007) to evaluate correlation differences between independent samples showed two significant results when compared by

gender: (a) the negative correlation between Ludus and Agape was significantly stronger for males than females (–.44 vs. –.20; $z = 3.70$, $p < .05$), and (b) the negative correlation between Ludus and Storge was significant for males (–.24) but not for females (–.04; $z = 3.05$, $p < .05$).

TABLE 1
Subscale intercorrelations, means, standard deviations, and reliabilities by gender

Love style	Eros	Ludus	Storge	Pragma	Mania	Agape	*M*	*SD*	Alpha
Eros	1.00	–.37	.17	–.11	.16	.48	27.19	4.48	.79
Ludus	–.33	1.00	–.24	.32	–.06	–.44	18.01	5.46	.74
Storge	.17	.04	1.00	.05	.04	.21	23.49	4.35	.64
Pragma	–.01	.25	.15	1.00	.23	.08	18.36	5.20	.73
Mania	.21	.02	.11	.16	1.00	.39	19.18	5.42	.75
Agape	.38	–.20	.29	.09	.40	1.00	25.13	4.18	.70
M	28.27	15.19	24.17	18.06	19.91	24.51			
SD	4.22	5.06	5.16	5.61	5.25	4.53			
Alpha	.67°	.69	.76	.70	.72	.75			
$t(df = 942)$	3.68	8.10	2.06	.84	2.08	2.10			
$p \leq$	.0002	.0001	.039	.401	.038	.036			

Note. Males' correlations ($n = 364$) appear above the diagonal; females' correlations ($n = 580$) appear below. Correlations above .11 are significant at $p < .036$. °Alpha coefficients are significantly different from each other.

SCALE REVISION ANALYSIS

We examined the internal consistencies of the Love Attitudes subscales by gender to determine if the exclusion of one or more items would augment the alpha coefficient. Items could not be dropped from both the Ludus and Mania subscales to produce an increase in internal consistency. Excluding Items 1 and 25 from the Eros subscale produced an increase in the alpha coefficient for both male and female subsamples (improved alphas = .80 and .77, respectively). Similarly, excluding Items 3 and 9 from the Storge subscale increased the alphas for the male and female subsamples (improved alphas = .74 and .77, respectively); excluding Item 16 (Pragma) increased the alpha to .74 and .76 for males and females, respectively. However, the analysis for the Agape subscale showed an increase in alpha in the male subsample (improved alpha = .73) when Item 18 was excluded, and in the female subsample (improved alpha = .78) when Item 6 was excluded. This differential item exclusion for Agape suggests unique interpretation of those listed items as a function of respondent gender; users of the instrument should be cautioned when interpreting mean differences for the Agape subscale.

CONFIRMATORY AND EXPLORATORY FACTOR ANALYSES

Results showed the hypothesized six-factor model was misspecified for the full dataset: $\chi^2(813) = 2982.94$, $p < .001$; RMSEA = .095; NFI = .63; CFI = .70; AGFI = .77. When divided by gender, results remained misspecified for both the female sample: $\chi^2(813) = 1800.35$, $p < .001$; RMSEA = .080; NFI = .63; CFI = .75; AGFI = .78; and the male sample: $\chi^2(813) = 2745.08$, $p <$

.001; RMSEA = .095; NFI = .44; CFI = .52; AGFI = .64. Since the proposed six-factor model did not fit the empirical data, it was not reasonable to conduct tests of measurement invariance (Milfont & Fischer, 2010). Alternatively, we pursued an exploratory factor analysis to determine whether a specific unidentified model existed in either subsample of our data.

Exploratory factor analysis — divided by gender — was conducted using principal axis factoring (with squared multiple correlations as prior communality estimates) and varimax (orthogonal) rotation of the extracted factors (based on eigenvalues above unity). Although a correlated factor model was explored using direct oblimin rotation, this was dismissed following inspection of especially modest to nonsignificant factor intercorrelations. Both male and female subsamples suggested a six-factor model, and the rotated solution (along with proportion of explained variance) can be found in Table 2. We observed few instances of item cross-loadings over multiple factors, however several items did not load on the hypothesized factor or at least evenly by gender.

TABLE 2
Exploratory factor analysis by gender

	Eros		Mania		Pragma		Ludus		Storge		Agape	
Item	M	F	M	F	M	F	M	F	M	F	M	F
36	.69	.55										
31	.69	.71										
37	.69	.47										
19	.66	.73										
13	.65	.52										
7	.64	.57										
15	.59	.52										
6	.53	.46										
33	.46	.37										
25	.45	–							–.35	–.41		
29			.68	.65								
17			.66	.52								
23			.59	.67								
5			.58	.37								
35			.50	–								
18			.46	.38							.39	
11			.46	.54								
41			.42	.40								
40					.74	.56						
34					.69	.75						
4					.53	.48						
10					.48	.49						
28					.47	.62					.40	
22					.46	.56						
14							.62	.65				
26							.57	.51				
8							.48	.57				
9							–.44	–				
2							–	.41				

(table 2 continues)

Table 2 (continued)

	Eros		Mania		Pragma		Ludus		Storge		Agape	
Item	M	F	M	F	M	F	M	F	M	F	M	F
38							–	.42				
21									.72	.77		
27									.68	.71		
39									.54	.77		
3									.52	–		
32									–	.37		
24											.56	.73
42											.45	.58
20		–.42									.42	–
Var. ex	12%	9%	7%	6%	7%	6%	6%	5%	5%	5%	4%	5%

Note. Factor loadings below .35 are not included in the table; proportion of explained variance appears at the bottom of the table. All 42-items are presented as in the original article (Hendrick & Hendrick, 1986).

Factor 1 (Eros) consisted of 10 items, enveloping four more items than expected (Items 6, 15, 33, and 36 from other factors); whereas Item 25 contributed in the male subsample, it did not contribute for the female subsample. Factor 2 (Mania) consisted of eight items, incorporating Item 18 from Agape for both subsamples, and Item 35 was not included in the female subsample. Factor 3 (Pragma) consisted of six items, excluding Item 16 for both subsamples. Factor 4 (Ludus) also consisted of six items, and excluded Items 2 and 38 for males and Item 9 for females. Furthermore, Item 20 was a contributor to Agape in the male subsample, but a negative contributor to Eros in the female subsample. Factor 5 (Storge) consisted of five items, but incorporated Item 25 (an Eros item) for both subsamples. Finally Factor 6 (Agape) consisted reliably of only two items for both subsamples — this scale will need further development in future investigations.

Discussion

The present study investigated the comparability across gender of the Love Attitudes Scale based on Lee's (1973) Color Theory of Love. Initial tests of sex differences showed five of Lee's six love subscales were significant: males scored higher for Ludus and Agape, females higher for Eros, Mania, and Storge (cf. Davies, 1996; Hendrick & Hendrick, 1986; Hendrick et al., 1984; Lin & Huddleston-Casas, 2005). However, for a valid test or comparison of subscales, it must be ensured that the subscales are invariant across populations — in the present case, respondent gender. Invariance can be demonstrated through both confirmatory and exploratory factor (and even reliability) analyses, outlining comparable factor solutions and alpha coefficients. Whereas it was hypothesized that male and female factor solutions should be comparable, the present results failed to support this pivotal assumption.

Surprisingly, results of the confirmatory factor analysis showed that the solution did not fit the hypothesized six-factor solution for the entire population and for each gender. Because tests of gender invariance were not appropriate; that is, the lack of model fit in the Love Attitudes Scale should caution researchers against using the scale to make comparisons across genders and

inferences in the population. This is the first study to find the six-factor solution for the Love Attitudes Scale to not be a good fit for the sample (Hendrick & Hendrick, 1986, 1989; Hetsroni, 2012; Murthy et al., 1996; Neto, 2007). Exploratory follow-up analyses showed modestly differential composition of the six factors across gender, and it would prove useful to take this into consideration prior to group comparisons. It is noteworthy that despite the above misspecifications, the alpha coefficients were reasonable for most subscales and for either sex.

Limitations are mentioned to promote interpretation and future research. These data were collected from a university setting where the majority of individuals have common ages, education levels, and socioeconomic backgrounds. Their aforementioned misspecification on the Love Attitudes Scale may reflect current differences in love specific to this population that did not exist when the scale was created. Future research is first needed to find a model that appropriately fits the data using exploratory factor analysis. Then, confirmatory factor analysis is needed to test the new model within a separate sample. When these questions have been answered, investigations of gender invariance on the revised Love Attitudes Scale can be revisited, if appropriate. Due to the restrictions of the sample, it is of additional importance to test if the current Love Attitudes Scale is better suited to a sample with different ages, education levels, relationship durations, and socioeconomic backgrounds.

Herein we caution researchers electing to use the Love Attitudes Scale. It urges further validity testing to determine what subscales can be modified so as to render them more applicable across populations.

NOTES

1. Aboriginal peoples in Canada.
2. The present paper uses an accurate representation of the items and order of the Love Attitudes Scale (Hendrick & Hendrick, 1986).

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