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Assessment 2008; 15; 36
DOI: 10.1177/1073191107306140

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The most widely used instrument to measure alexithymia is the 20-item Toronto Alexithymia Scale (TAS-20). However, different factor structures have been found in different languages. This study tests six published factor models and metric invariance across clinical and nonclinical samples. It also investigated whether there is a method effect of the negatively keyed items. Second-order models with alexithymia as a higher order factor are tested. Confirmatory factor analyses showed that the original factor model with three factors—difficulty identifying feelings (DIF); difficulty describing feelings (DDF) and externally oriented thinking (EOT)—is the best fitting model. Partial measurement invariance across samples was illustrated but requires further study. A weakness of the model is the low internal consistency of the third factor. Because models with a method factor had a better fit, future reconsideration of the negatively formulated items seems necessary. No evidence was found for the second-order models.

Keywords: Alexithymia; factorial validity; 20-item Toronto Alexithymia Scale; measurement invariance

The construct of alexithymia, first coined by Sifneos (1973), reflects difficulties in affective self-regulation and includes four characteristics: (a) difficulty identifying feelings and distinguishing between feelings and the bodily sensations of emotional arousal, (b) difficulty describing feelings to other people, (c) constricted imaginal processes, and (d) a stimulus-bound, externally oriented style. The concept of alexithymia originated within psychoanalysis, but wider scientific interest has since been established. Variables that have been related to the alexithymia range from neighbouring concepts like mentalization to multiple biological markers (Taylor, Bagby, & Parker, 1997). The widened interest in alexithymia is also illustrated by the growing body of research that no longer exclusively focuses on psychosomatic illness but on a broad range of somatic and psychological problems as well (Taylor et al., 1997), hence the need for psychometric instruments that are valid in different types of populations.

The most widely used instrument to measure alexithymia is the 20-item Toronto Alexithymia Scale (TAS; Bagby, Parker, & Taylor, 1994; Bagby, Taylor, & Parker, 1994). The TAS-20 has been cross-validated in different languages, for example Italian (Bressi et al., 1996), Finnish (Joukamaa et al., 2001), Japanese (Komaki et al., 2003), Hindi (Pandey, Mandal, Taylor, & Parker, 1996), German (Parker, Bagby, Taylor, Endler, & Smithz, 1993), and Swedish (Simonsson-Sarnecki et al., 2000; for a review, see Taylor, Bagby, &

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Assessment, Volume 15, No. 1, March 2008 36-47
DOI: 10.1177/1073191107306140

Parker, 2003); and in different populations, like community populations (Parker, Taylor, & Bagby, 2003), clinical versus nonclinical populations (Loas et al., 2001), and different cultures (Parker, Shaughnessy, Wood, Majeski, & Eastabrook, 2005). Bagby, Parker, et al. (1994) originally proposed a three-factor structure with Factor 1, difficulty identifying feelings (DIF); Factor 2, difficulty describing feelings (DDF); and Factor 3, externally oriented thinking (EOT). This factor solution has often, but not consistently, been replicated. Some studies found that the first two factors collapsed into one single factor (Erni, Lotscher, & Modestin, 1997; Kooiman, Spinhoven, & Trijsburg, 2002; Loas, Otmani, Verrier, Fremaux, & Marchand, 1996). Others found that the last factor (EOT) decomposed into two factors: "pragmatic thinking" (PR) and "lack of subjective significance or importance of emotions" (IM) (Haviland & Reise, 1996; Ritz & Kannapin, 2000).

Some remarks can be made with regard to these findings. First, different statistical techniques are used in the different studies, like principal components analysis (PCA), confirmatory factor analysis (CFA) and item response theory, which makes them hard to compare. Because the investigation of the underlying dimensional structure of the TAS-20 is no longer in an exploratory stage, CFA is assumed to be the most appropriate technique (Taylor et al., 2003). However, also with CFA, attention should be paid to certain issues. With CFA, choices have to be made concerning estimation method, fit indices, and cutoff criteria, and these choices may influence results and, consequently, interpretations of those results. Often no attention is paid to the distributional features of the data, even when univariate and multivariate normality assumptions are violated. There are also problems with fit indices. Frequently, indices like the GFI and AGFI are used, even though they are criticized in statistical literature for their dependence on sample size (e.g., Hu & Bentler, 1998). These problems will be taken into account in the present study.

Second, most problems with the factor structure of the TAS-20 arise with non-English versions of the questionnaire. Consequently, the underlying structure of the instrument in other languages and other cultures needs to be investigated carefully. It is argued that alexithymia may be a culture-bound construct that reflects the emphasis of Western psychotherapy on introspection and reflection (see Taylor et al., 2003). This implies that cultural differences may be found in Eastern societies, but if differences are found between the Dutch TAS-20 and other Western European countries, we expect them to be because of translation issues (or differences in language use) rather than real cultural differences. Studies on the Dutch version of the TAS-20 show diverging results. De Gucht, Fontaine, and Fischler (2004) found a three-factor structure; however, they used PCA and a replication of their result with CFA is therefore necessary. On the other hand, Kooiman et al. (2002) found a two-factor model, also using PCA and proposed to leave out four items because of low factor loadings. Again, their findings should be confirmed. A firm knowledge of the underlying dimensions of the TAS-20 used in Belgian- or Dutch-speaking populations is important to guide interpretations of scale scores in further research. Furthermore, in non-English versions of the TAS-20, problems often arise with (some of) the negatively keyed items (indicated by low factor loadings). It would be useful therefore to formally test the possibility of a method effect by adding a method factor to the models for these items.

A third remark is that most studies that use CFA only test one or two models, although it appears useful and necessary to compare the originally proposed three-factor model with the multiple solutions found by other researchers. The study by Müller, Bühner, and Ellgring (2003) is an important exception with respect to this strategy. These authors tested five models, namely, a one-factor model, a two-factor model with DIF and DDF forming one factor, a three-factor model with DIF and DDF as one factor, but with EOT split into two factors (pragmatic thinking [PR] and lack of subjective significance or importance of emotions [IM]), and finally a newly created four-factor model, which provided the best fit to the data. Because this model had never been tested before, replication of its findings is important.

Our final remark points to a more general shortcoming in all studies on the factor structure of the TAS-20 we are aware of, namely, that the invariance of the factor structure across different groups has hardly ever been examined. Often research is restricted to one population, where an examination of this issue is not possible (Parker et al., 1993; Simonsson-Sarnecki et al., 2000). When clinical and nonclinical populations are studied within the same study, different factor solutions are frequently found for the two groups (Haviland & Reise, 1996; Müller et al., 2003), or the invariance of the solution is not explicitly tested (Bagby, Parker, et al., 1994; Loas et al., 2001). We suggest that if scale score differences across groups are to be compared, researchers should examine whether different groups of subjects interpret the TAS-20 items in similar ways by examining metric invariance of the factor solution.

In this article, we provide a comparative assessment of different TAS-20 factor models in clinical and nonclinical samples. We start from the work of Müller et al. (2003), who tested five different factor models in a clinical and a community sample. Their clinical sample consisted of 204 patients (59.3% women; mean age = 47.1 years) from a hospital for psychosomatic disorders and from a clinic for substance abuse. Consequently, this clinical sample cannot be considered representative of the general psychiatric population. Their nonclinical sample consisted of 224 adults (58.5% women; mean age = 41.5 years), who were office workers as well as skilled workers. This sample appears to be representative of the general population. The authors mention the moderate sample sizes and the advanced age of both samples as limitations of the study.

The models were judged using the root mean square error of approximation (RMSEA < .06) and the standardized root mean square residual (SRMR < .11) as cutoff criteria (Müller et al., 2003). However, the cutoff of .11 for the SRMR seems too loose, because all their models actually meet this criterion, and moreover in statistical literature the cutoff guidelines for the SRMR are more stringent (Hu & Bentler, 1999).

Next to the five models tested by Müller et al. (2003), we will also test the 16-item model for the Dutch TAS-20 proposed by Kooiman et al. (2002). After selecting the best fitting model, metric invariance across groups of this factor solution will be investigated.

In addition, we will test the possibility of a method effect of the negatively keyed items by adding a method factor to the model(s) described above, which provide good fit to the data. Finally, because it is assumed that the subscales of the TAS-20 are dimensions of the overarching alexithymia construct, we will also test second-order models for the multiple-factor models with alexithymia as the general underlying higher order factor. Also these models will be tested in clinical and nonclinical samples.

METHOD

Participants

The clinical sample consisted of 404 outpatients (70% women) of mental health care centers in Belgium. All participants were provided with written information on the study and gave informed consent. Mean age was 38.4 years (*SD* = 10.6). The most frequent axis I *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.) diagnoses were mood disorders (44%), anxiety disorders (15%), adjustment disorders (4%), somatoform disorders (4%), substance-related disorders (3%), eating disorders (2%), and other conditions that may be a focus of clinical attention (11%). Of all participants, 74% received a diagnosis on axis II. Borderline PD (12%), PD not otherwise specified (12%) and dependent PD (9%) were the most frequently occurring diagnosis.

The nonclinical sample consisted of 157 university (psychology) students (84.7% women), and their mean age was 20.73 years (*SD* = 2.53). They completed the TAS-20 after giving informed consent.

Measures

The Dutch translation of the TAS-20 was administered to each sample (Kooiman et al., 2002). This scale was obtained by means of a translation and back translation procedure, and the final version was established in consultation with Bagby, one of the original authors of the instrument. Each item is scored on a 5-point Likert-type scale, with 5 items negatively keyed. Total scores range from 20 to 100, with higher scores indicating greater alexithymia.

Statistical Analysis

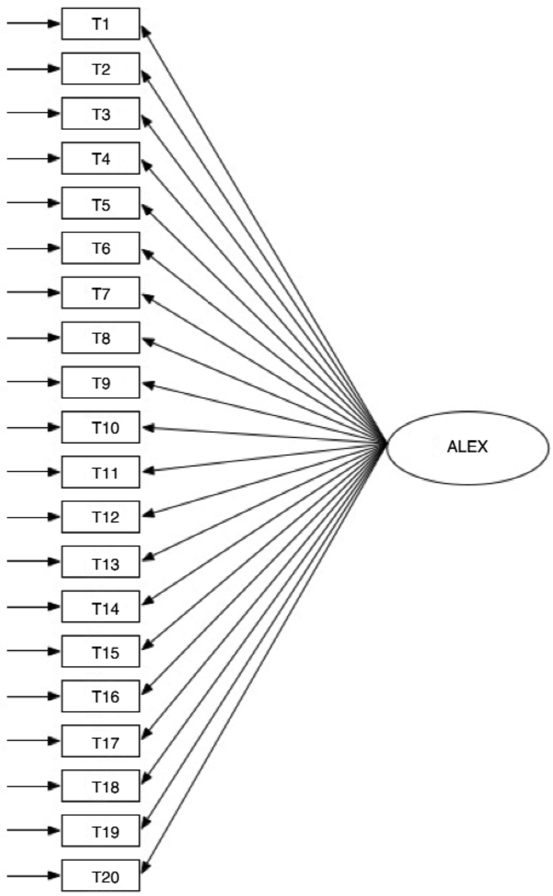
Factorial validity of the TAS-20 was tested using CFA of covariance matrices by means of Lisrel 8.7 (Maximum Likelihood Estimation; Jöreskog & Sörbom, 1993). Most variables had significant skewness and kurtosis, and thus the assumption of multivariate normality was violated. Consequently, the asymptotic covariance matrices were computed and robust maximum likelihood estimation was used. The factors were allowed to correlate each time, and correlations between error terms were not permitted. In evaluating the model fit, the following indices were considered: the Comparative Fit Index (CFI), the SRMR, and the RMSEA (Browne & Cudeck, 1993; Jöreskog & Sörbom, 1993; Marsh, Hau, & Wen, 2004). The following criteria were used as standards of acceptable fit: CFI > .90; SRMR < .09; and RMSEA < .06; higher boundary of RMSEA 90% confidence interval < .08 (Browne & Cudeck, 1993; Jöreskog & Sörbom, 1993; Marsh et al., 2004). The Satorra-Bentler χ^2 statistic, which controls for nonnormality of the variables, was reported to examine differences in model fits. (This statistic is not used to evaluate single models because it is highly dependent on sample size.) Also the Akaike information criterion (AIC) was reported and used to compare nonnested models. The AIC gives advantage to more parsimonious models (more degrees of freedom) and, in comparing models, the model with the lowest AIC is considered best (Tanaka, 1993).

Measurement invariance was tested starting from the CFI (Chueng & Rensvold, 2002). The hypothesis of invariance was accepted if the difference in CFI between a hypothetical model (H1), in which all factor-loading parameters are equal across groups, and an unconstrained multigroup model (H0) was smaller than or equal to .01. If the hypothesis of metric invariance cannot be confirmed, a series of tests will be performed to locate items responsible for overall noninvariance (Byrne, Shavelson, & Muthén, 1989).

Tested Models

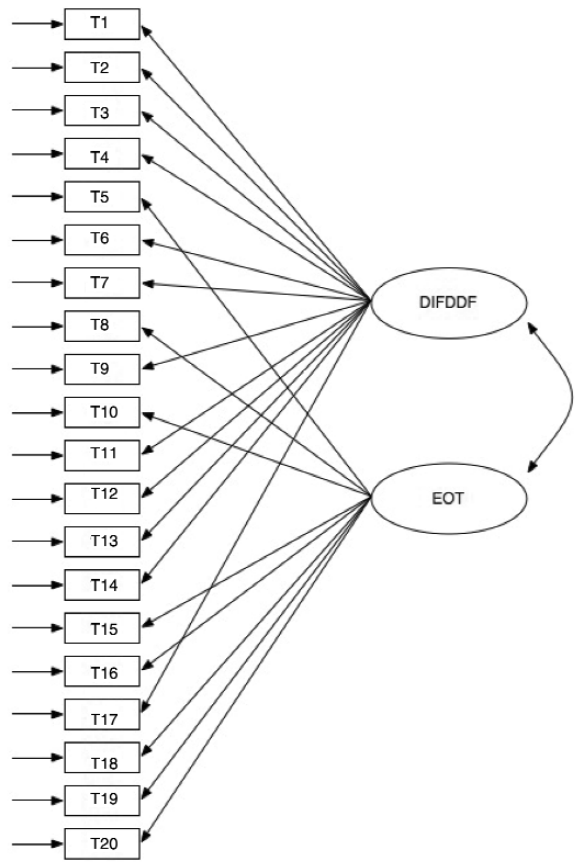
Six different models were compared: (a) a one-factor model, where it is assumed that all items reflect one

FIGURE 1
Model (a)



NOTE: TAS-20 = 20-item Toronto Alexithymia Scale; T1, T2, . . . , T20 = TAS-20 Item 1, Item 2, . . . , Item 20; ALEX = alexithymia.

FIGURE 2
Model (b)



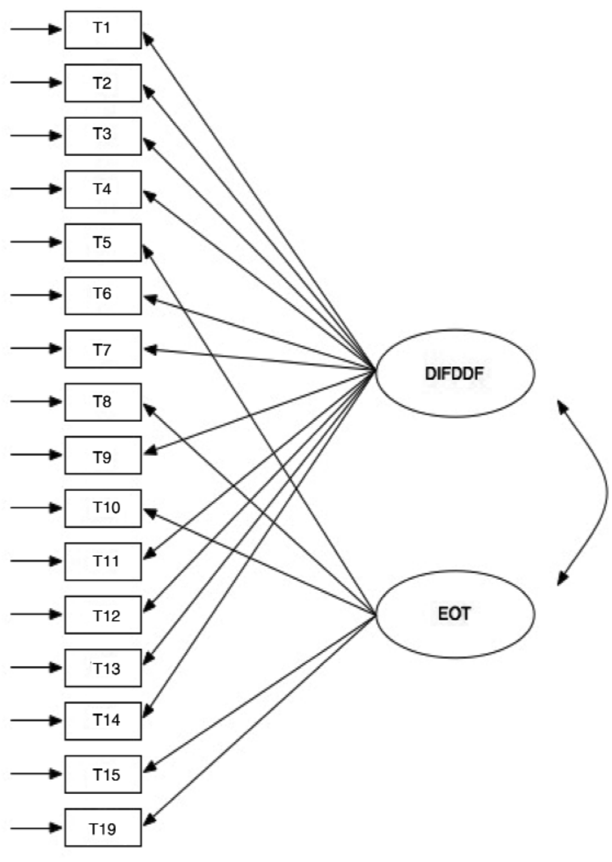
NOTE: TAS-20 = 20-item Toronto Alexithymia Scale; T1, T2, . . . , T20 = TAS-20 Item 1, Item 2, . . . , Item 20; DIFDDF = Factor 1: difficulty identifying and describing feelings; EOT = Factor 2: externally oriented thinking.

underlying construct, namely, alexithymia (see Figure 1); (b) a two-factor model with DIF and DDF forming one factor (Items 1, 2, 3, 4, 6, 7, 9, 11, 12, 13, 14, and 17) and EOT as the second factor (Items 5, 8, 10, 15, 16, 18, 19, and 20; Erni et al., 1997; Haviland & Reise, 1996; Loas et al., 1996; see Figure 2); (c) a two-factor model with 16 items as proposed by Kooiman et al. (2002) with DIF and DDF forming again one factor (Items 1, 2, 3, 4, 6, 7, 9, 11, 12, 13, and 14) and EOT as the second factor (Items 5, 8, 10, 15, and 19; see Figure 3); (d) the model as proposed by Bagby, Parker et al. (1994), with three factors: DIF (Items 1, 3, 6, 7, 9, 13, and 14), DDF (Items 2, 4, 11, 12, and 17), and EOT (Items 5, 8, 10, 15, 16, 18, 19, and 20; see Figure 4); (e) a three-factor solution, but with DIF and DDF as one factor and EOT split into two factors: "pragmatic thinking" (PR, Items 5, 8, and 20) and "lack of subjective significance or importance of emotions" (IM, Items 10, 15, 16, 18, and 19; Ritz & Kannapin, 2000; see Figure 5); (f) and a model with four factors (DIF, DDF, PR, and IM) as was found by Müller et al. (2003; see Figure 6).

Next, for those models described above that provide good fit to the data, a model will be tested with an additional method factor on which the negatively keyed items load (Items 4, 5, 10, 18, and 19).

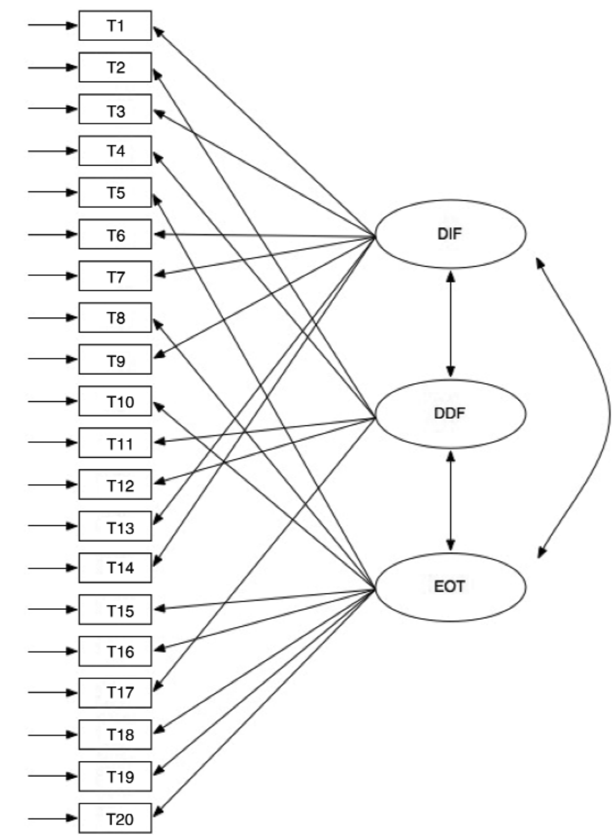
Finally, for the models (d), (e), and (f) a second-order model will be tested, with the general alexithymia concept as a higher order factor. Normally four first-order factors are considered necessary to statistically test the fit of one hypothesized second-order factor because the second-order portion of the model has to be overidentified to be properly tested for fit (Chen, Sousa, & West, 2005). However, for the three first-order factor models, we gain one additional degree of freedom by specifying an equality constraint

FIGURE 3
Model (c)



NOTE: TAS-20 = 20-item Toronto Alexithymia Scale; T1, T2, . . . , T15, T19 = TAS-20 Item 1, Item 2, . . . , Item 15, Item 19; DIFDDF = Factor 1: difficulty identifying and describing feelings; EOT = Factor 2: externally oriented thinking.

FIGURE 4
Model (d)



NOTE: TAS-20 = 20-item Toronto Alexithymia Scale; T1, T2, . . . , T20 = TAS-20 Item 1, Item 2, . . . , Item 20; DIF = Factor 1: difficulty identifying feelings; DDF = Factor 2: difficulty describing feelings; EOT = Factor 3: externally oriented thinking.

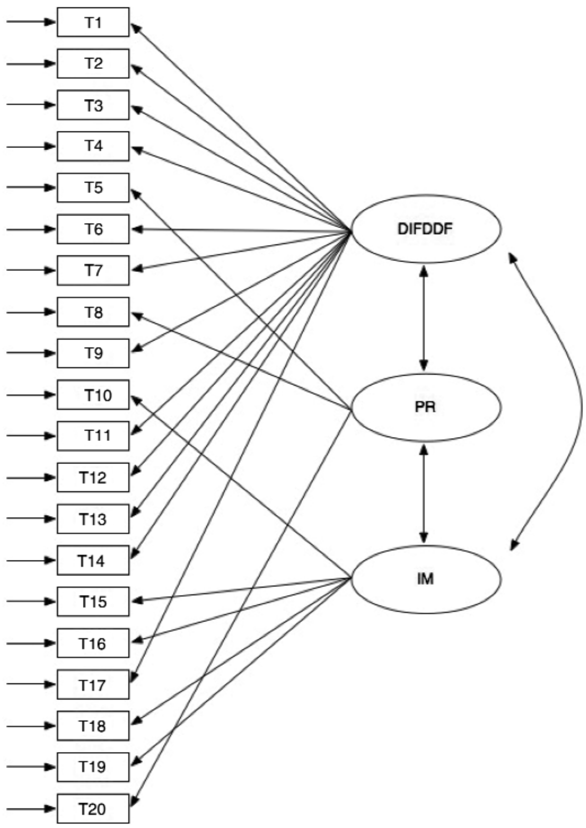
between two residuals of the first-order factors (Byrne, 2005). As an example, model (d) with a second-order factor "alexithymia" is presented in Figure 7.

RESULTS

First, we will look at the six basic first-order models (a, b, c, d, e, f). The fit indices for these models are presented in Table 1. The one-factor model (a) showed a bad fit in both samples on all fit indices (except for the SRMR in the clinical sample). Also the two-factor model with 20 items (b) did not fit the data in either sample. Both the RMSEA and the CFI indicate bad fit—only the SRMR value is below the cutoff value. The same holds for Kooiman's two-factor model with 16 items (c). On the other hand, model (d) shows acceptable fit at most levels. Only, for the RMSEA the values are slightly high; however, the upper boundary of the 90% confidence interval is below .08. The three-factor model (e) again shows no acceptable fit on all criteria in either sample, except for the SRMR. Finally, the four-factor model (f) shows comparable fit to model (d). Consequently, in both samples models (d) and (f) have the best fit. Based on our fit criteria, both models have acceptable fit at most levels, except for the somewhat high RMSEA values. The Lisrel estimates of all factor loadings in both models (except for Item 18 in the student sample) proved to be significant ($p < .05$). The standardized estimates are presented in Table 2 and the correlations between the latent factors in Table 3.

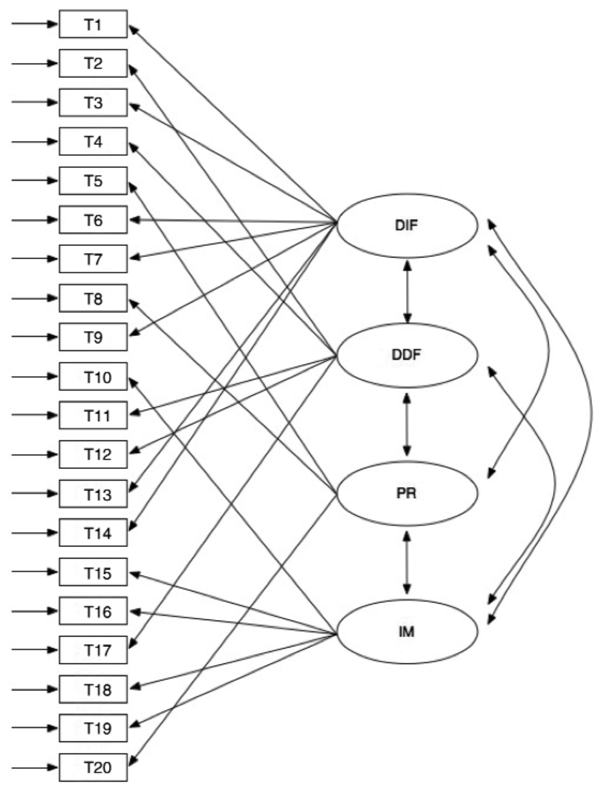
Means, mean interitem correlations, and internal consistency coefficients of models (d) and (f) are presented in Table 4. The total TAS-20 score and the factors DIF and DDF prove to have acceptable internal consistency. The

FIGURE 5
Model (e)



NOTE: TAS-20 = 20-item Toronto Alexithymia Scale; T1, T2, . . . , T20 = TAS-20 Item 1, Item 2, . . . , Item 20; DIFDDF = Factor 1: difficulty identifying and describing feelings; PR = Factor 2:pragmatic thinking; IM = Factor 3: lack of importance of emotions.

FIGURE 6
Model (f)



NOTE: TAS-20 = 20-item Toronto Alexithymia Scale; T1, T2, . . . , T20 = TAS-20 Item 1, Item 2, . . . , Item 20; DIF = Factor 1: difficulty identifying feelings; DDF = Factor 2: difficulty describing feelings; PR = Factor 3: pragmatic thinking; IM = Factor 4: lack of importance of emotions.

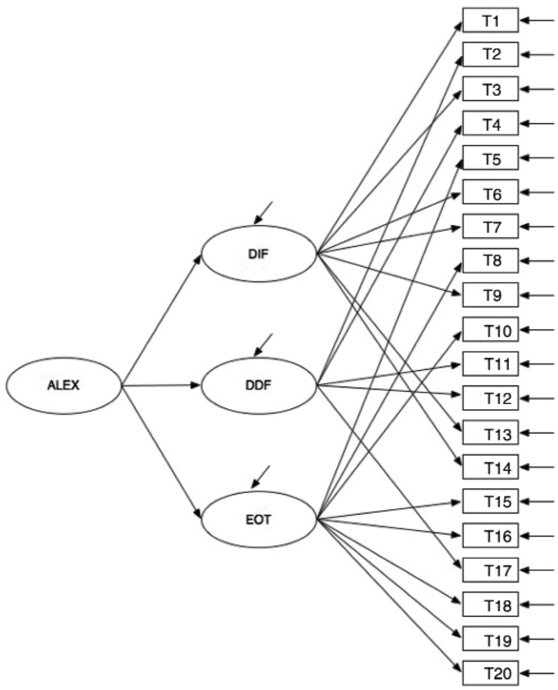
EOT-factor, and its subfactors PR and IM, however, show low α-coefficients, which is problematic for both models (d) and (f).

To further test whether model (f) adds in value in relation to model (d), we compared both models by means of a Satorra-Bentler corrected χ^2-differences test. Model (f) showed no significant differences compared to model (d) in either sample (clinical sample: χ^2-difference = 1.83, $df = 3$, $p = .61$; student sample: χ^2-difference = .09, $df = 3$, $p = .99$). Based on this test no model can be preferred. However, the high correlations between IM and PR (clinical sample: $r = .79$; student sample: $r = .98$; Table 3) indicate that both factors should be combined. Based on this finding, as well as for reasons of parsimony (which is also reflected in the lower AIC values for the (d) models), we prefer model (d) to model (f).

Subsequently, we tested metric invariance of the three-factor solution (d) across the two samples. We observed that CFI $H_0 = .906$ and CFI $H_1 = .919$. The difference between both values was larger than .01, which indicates that measurement invariance cannot be assumed. Consequently, we ran a series of 20 tests to locate the items that caused overall absence of invariance. In these tests, each time we allowed one TAS-20 item to have different factor loadings across samples, whereas all other items were held invariant. Only when Item 19 was allowed to have different factor loadings across samples, the CFI-difference became smaller than .01 (CFI $H_0 = .91$).

Because both models (d) and (f) had acceptable fit, we next tested these models with an additional method factor for the negatively keyed items. In both samples, these models with a method factor showed an improvement over

FIGURE 7
Second-order model (d)



NOTE: TAS-20 = 20-item Toronto Alexithymia Scale; T1, T2, . . . , T20 = TAS-20 Item 1, Item 2, . . . , Item 20; DIF = Factor 1: difficulty identifying feelings; DDF = Factor 2: difficulty describing feelings; EOT = Factor 3: externally oriented thinking; ALEX = second-order factor: alexithymia.

the same model without the method factor and this on all fit indices (see Table 5). Also the AIC—which favors more parsimonious models—was consistently lower in the models with a method factor.

Finally, for models (d), (e), and (f), a second-order model was tested. All fit indices (see Table 6) indicated a worse fit for the models with a second-order factor, except for model (e) where they have equal values. Also the AIC indicates a worse fit for the second-order models—even though these models have more degrees of freedom—except for model (e), where there is a slightly better AIC value for the second-order model, but the difference is negligible.

DISCUSSION

In this study, we first tested six basic first-order factor models for the TAS-20 by means of CFA based on clinical and nonclinical data. The one-factor model provided bad fit and so did all the two-factor models. Consequently, we found no evidence of the model proposed by Kooiman et al. (2002) for the Dutch TAS-20. Because CFA is a more appropriate method to investigate factorial validity when there are clear hypotheses, we consider our findings more informative.

Two models did provide good fit to the data, and these were the original three-factor model DIF-DDF-EOT (Bagby, Parker, et al., 1994) and the four-factor model DIF-DDF-PR-IM (Müller et al., 2003). Based on a χ^2-differences test, we found that the fit of the two models were not significantly different. However, correlations between factors IM and PR, in the four-factor model were high, suggesting that collapsing the two would be plausible. Consequently, and for reasons of parsimony, we select the three-factor model, originally formulated by Bagby and colleagues as the optimal solution, which has been demonstrated in a number of studies (for a review see: Taylor et al., 2003).

When we compare our results with those of Müller et al. (2003), a number of differences can be seen. First, the two-factor model (b) did not provide acceptable fit in either of our samples, whereas Müller and colleagues found an acceptable fit in the clinical sample. Second, we could not replicate their finding that the four-factor solution provides a significantly better fit than the original three-factor model (although this three-factor model also provided a good fit in the clinical sample of Müller et al.). Third, Müller and colleagues could not find any good-fitting model for the nonclinical sample, whereas we found comparable results for both samples. These differences are not due to different cutoff criteria, because changing these norms would not imply different conclusions. In comparing models, however, our use of the Satorra-Bentler corrected χ^2, which is more robust for violations of normality assumptions, might be more informative than the regular χ^2 used in Müllers study. However, their data did not really violate normality assumptions, so these different χ^2s should not cause substantially different conclusions. This is therefore not an explanation for the differing results.

Possible explanations for the failure to replicate the findings of Müller et al. (2003) are to be found in the sample characteristics and the different language versions of the TAS-20 used for the research. First, our clinical sample, predominantly female, consisted of outpatients instead of inpatients, and was more heterogeneous than the sample of Müller and colleagues, which was recruited in a hospital for psychosomatic disorders and substance abuse. Major differences however exist between the nonclinical samples. Our sample was a student sample, mostly young women, whereas the sample of Müller et al. was more representative of the general population. Consequently, the results for the nonclinical groups are hard to compare, and more

TABLE 1
Fit Indices for Model (a), (b), (c), (d), (e), and (f)

Sample	*Model*	*Number of Items*	df	*SB-χ^2*	*SRMR*	*RMSEA (90% CI)*	*CFI*	*AIC*
Clinical	(a) ALEX	20	170	918.35	.089	.100 (.098-.110)	.80	998.35
	(b) DIF/DDF-EOT	20	169	672.23	.079	.086 (.079-.093)	.86	754.23
	(c) DIF/DDF-EOT	16	103	480.59	.082	.095 (.087-.010)	.88	546.59
	(d) DIF-DDF-EOT	20	167	453.71	.068	.065 (.058-.073)	.92	539.71
	(e) DIF/DDF-PR-IM	20	167	675.07	.078	.087 (.080-.094)	.86	761.07
	(f) DIF-DDF-PR-IM	20	164	454.86	.068	.066 (.059-.074)	.92	546.86
Student	(a) ALEX	20	170	411.26	.095	.095 (.084-.110)	.79	491.26
	(b) DIF/DDF-EOT	20	169	337.50	.085	.080 (.067-.092)	.86	419.50
	(c) DIF/DDF-EOT	16	103	207.29	.081	.081 (.065-.096)	.90	273.29
	(d) DIF-DDF-EOT	20	167	267.12	.081	.062 (.048-.076)	.91	353.12
	(e) DIF/DDF-PR-IM	20	167	336.94	.085	.081 (.068-.093)	.85	422.94
	(f) DIF-DDF-PR-IM	20	164	266.08	.081	.063 (.049-.077)	.91	358.08

NOTE: SB-χ^2 = Satorra-Bentler Scaled Chi-Square; SRMR = standardized root mean square residual; RMSEA = root mean square error of approximation; 90% CI = 90% confidence interval of the RMSEA; CFI = comparative fit index; AIC = Akaike information criteria. All χ^2 were significant with $p < .01$. Models (a), (b), (c), (d), (e), and (f) as described in Methods; ALEX = alexithymia; DIF = difficulty identifying feelings; DDF = difficulty describing feelings; EOT = externally oriented thinking; PR = pragmatic thinking; IM = lack of importance of emotions.

TABLE 2
Standardized Parameter Estimates From the Confirmatory Factor Analyses in the Clinical (*N* = 404) and Student Sample (*N* = 157)

		Model/Number of Factors			
		Clinical Sample		*Student Sample*	
		(d) 3	*(f) 4*	*(d) 3*	*(f) 4*
Difficulty identifying feelings					
1	I am often confused about what emotion I am feeling	.63	.63	.66	.66
3	I have physical sensations that even doctors don't understand	.51	.51	.43	.43
6	When I am upset, I don't know if I am sad, frightened, or angry	.57	.57	.57	.57
7	I am often puzzled by sensations in my body	.65	.65	.56	.56
9	I have feelings that I can't quite identify	.74	.74	.75	.75
13	I don't know what's going on inside me	.69	.68	.68	.68
14	I often don't know why I am angry	.61	.61	.65	.65
Difficulty describing feelings					
2	It is difficult for me to find the right words for my feelings	.80	.79	.84	.84
4	I am able to describe my feelings easily	.68	.68	.84	.84
11	I find it hard to describe how I feel about people	.55	.55	.32	.32
12	People tell me to describe my feelings more	.57	.57	.37	.37
17	It is difficult for me to reveal my innermost feelings, even to close friends	.62	.62	.40	.40
Pragmatic thinking/Externally oriented thinking					
5	I prefer to analyze problems rather than just describe them	.51	.63	.44	.45
8	I prefer just to let things happen rather than to understand why they turned out that way	.33	.33	.54	.54
20	Looking for hidden meanings in movies or plays distracts from their enjoyment	.14	.15	.28	.29
Lack of importance of emotions/Externally oriented thinking					
10	Being in touch with emotions is essential	.42	.43	.35	.35
15	I prefer talking to people about their daily activities rather than their feelings	.60	.61	.26	.25
16	I prefer to watch "light" entertainment shows rather than psychological dramas	.46	.46	.24	.24
18	I can feel close to someone, even in moments of silence	.23	.23	.14*	.14*
19	I find examination of my feelings useful in solving personal problems	.29	.28	.68	.68

NOTE: Items 4, 5, 10, 18, and 19 are negatively keyed. Models (d) and (f) as described in Methods.
*Not significant at $p < .05$.

TABLE 3
Estimated Correlations Between TAS-20 Factors for Three- (d) and Four-Factor Models

Model	*Factors*	*F1*	*F2*	*F3*	*F4*
(d)	F1: DIF	—	.66*	.10	
	F2: DDF	.67*	—	.28*	
	F3: EOT	.13	.32*	—	
(f)	F1: DIF	—	.66*	.11	.08
	F2: DDF	.67*	—	.27*	.28*
	F3: PR	.05	.30*	—	.98*
	F4: IM	.14	.30*	.79*	—

NOTE: Correlations for the student sample: above the diagonal; for the clinical sample: below the diagonal. Models (d) and (f) as described in Methods; TAS-20 = 20-item Toronto Alexithymia Scale; DIF: difficulty identifying feelings; DDF: difficulty describing feelings; EOT: externally oriented thinking; PR: pragmatic thinking; IM: lack of importance of emotions.
*$p < .05$.

TABLE 4
Means, Standard Deviations, Internal Reliability Coefficients, and Mean Interitem Correlations (MIC) for Clinical and Student Samples

			TAS-20 Scores			
Sample	*Factors*	*Items*	M	(SD)	MIC	α
Clinical	Total score	20	56.52	11.34	.16	.80
	DIF	7	21.82	6.35	.39	.82
	DDF	5	15.84	4.71	.41	.78
	EOT	8	18.86	4.48	.14	.56
	PR	3	7.49	2.15	.13	.31
	IM	5	11.37	3.26	.16	.48
Student	Total score	20	42.26	8.63	.15	.78
	DIF	7	13.46	4.52	.38	.81
	DDF	5	11.82	3.73	.32	.70
	EOT	8	16.95	3.56	.13	.53
	PR	3	6.43	3.37	.18	.38
	IM	5	10.53	5.89	.10	.35

NOTE: TAS-20 = 20-item Toronto Alexithymia Scale; DIF = difficulty identifying feelings; DDF = difficulty describing feelings; EOT = externally oriented thinking; PR = pragmatic thinking; IM = lack of importance of emotions.

TABLE 5
Fit Indices for Model (d) + Method Factor and Model (f) + Method Factor

Sample	*Model*	*Number of Items*	df	*SB-χ^2*	*SRMR*	*RMSEA (90% CI)*	*CFI*	*AIC*
Clinical	(d) DIF-DDF-EOT + Method Factor	20	159	413.22	.062	.063 (.056-.070)	.93	515.22
	(f) DIF-DDF-PR-IM + Method Factor	20	155	410.75	.061	.064 (.057-.072)	.93	520.75
Student	(d) DIF-DDF-EOT + Method Factor	20	159	247.39	.077	.060 (.045-.074)	.92	349.39
	(f) DIF-DDF-PR-IM + Method Factor	20	155	232.19	.074	.056 (.041-.071)	.93	342.19

NOTE: SB-χ^2 = Satorra-Bentler Scaled Chi-Square; SRMR = standardized root mean square residual; RMSEA = root mean square error of approximation; 90% CI = 90% confidence interval of the RMSEA; CFI = comparative fit index; AIC = Akaike information criteria. All χ^2 were significant with $p < .01$. Models (d) and (f) as described in Methods; TAS-20 = 20-item Toronto Alexithymia Scale; DIF = difficulty identifying feelings; DDF = difficulty describing feelings; EOT = externally oriented thinking; PR = pragmatic thinking; IM = lack of importance of emotions.

TABLE 6
Fit Indices for Second-Order Models

Sample	*Model*	*Number of Items*	df	*SB-*χ^2	*SRMR*	*RMSEA (90% CI)*	*CFI*	*AIC*
Clinical	(d) DIF-DDF-eot second-order model	20	168[a]	464.59	.082	.066 (.059-.073)	.92	548.59
	(e) DIF/DDF-PR-IM second-order model	20	168[a]	675.93	.078	.087 (.080-.094)	.86	759.93
	(f) DIF-DDF-PR-IM second-order model	20	166	530.66	.076	.074 (.067-.081)	.90	618.66
Student	(d) DIF-DDF-EOT second-order model	20	168[a]	273.20	.089	.063 (.049-.077)	.91	357.20
	(e) DIF/DDF-PR-IM second-order model	20	168[a]	337.39	.085	.080 (.068-.093)	.85	421.39
	(f) DIF-DDF-PR-IM second-order model	20	166	296.47	.089	.071 (.058-.084)	.89	384.47

NOTE: SB-χ^2 = Satorra-Bentler Scaled Chi-Square; SRMR = standardized root mean square residual; RMSEA = root mean square error of approximation; 90% CI = 90% confidence interval of the RMSEA; CFI = comparative fit index; AIC = Akaike information criteria. All χ^2 were significant with $p < .01$. Models (d), (e), and (f) as described in Methods; DIF = difficulty identifying feelings; DDF = difficulty describing feelings; EOT = externally oriented thinking; PR = pragmatic thinking; IM = lack of importance of emotions.
a. The additional degree of freedom for these second-order models is obtained by the specification of an equality constraint between two residuals for purposes of model identification at the higher order level.

research in the general population is indicated. Second, Müller and colleagues used the German version of the TAS-20, whereas we used the Dutch version. Research with the German TAS-20 shows that four-factor structures have often been found (Franz, Schneider, Schafer, Schmitz, & Zweyer, 2001; Müller et al., 2003; Ritz & Kannapin, 2000), which may indicate differences at the level of language and/or culture. The correlations between IM and PR are higher in our sample than in the samples of Müller et al. (2003), and particularly in the nonclinical sample (clinical sample: $r = .70$; nonclinical sample: $r = .22$). This somewhat clarifies why the four-factor model was significantly different from the three-factor model in the German study. It is hard to make further statements about the relations between the two components of the EOT factor because a four-factor solution is hardly studied in other languages. Recently, Gignac, Palmer, and Stough (in press) did study a model where EOT was split into PR and IM, but this was in a nested model design with 5 factors that consists of a general alexithymia factor, as well as the DIF, DDF and EOT (PR-IM) factors. As a consequence of including the general alexithymia factor, their results are difficult to compare with ours or with Müller et al.'s (2003). However, the correlation of .41 Gignac et al. (in press) report between IM and PR does indicate that further research into the possible existence of two substantially different facets in the EOT-factor is warranted. Based on our study with a Dutch population, the original three-factor solution was plausible, thus indicating that the Dutch-translated TAS-20 measures the same constructs as the English version and that the translation is adequate.

Because we found that the three-factor solution provided an acceptable fit in both samples, testing metric invariance of the factor solution was the logical next step. Initially, the hypothesis of metric invariance could not be confirmed. However, we found that this was only because of Item 19. Byrne et al. (1989) suggest that because complete metric invariance is difficult to satisfy, partial invariance—with only a small proportion of the items being noninvariant—may be enough to meaningfully compare scores across different groups. In this light, our results suggest that substantive interpretations across different groups are plausible. It is nonetheless important to further investigate metric invariance of the TAS-20 factor structure across other groups—also across cultures—and to identify items that may be interpreted differently by different groups. A possible explanation for the difference between groups for Item 19 lies in its explicit referral to personal problems, which may have another connotation for students than for patients because the latter precisely search help for personal problems.

Even though our results indicate that the three-factor structure can be found in the Dutch TAS-20, like many other researchers who use English and non-English versions of the TAS-20, we found a problem with the internal consistency of the EOT-factor. Considering it is so widespread, this problem seems to be more because of characteristics of the instrument itself rather than of translation inadequacy and needs future attention. Possible directions are revision of the negatively formulated items, which seem to be problematic in several studies (see also Taylor et al., 2003), and revision of the items that repeatedly showed lower factor loadings (Bressi et al., 1996; Müller et al., 2003; Pandey et al., 1996; Simonsson-Sarnecki et al., 2000).

Because of the possible influence of the negatively keyed items, we also tested first-order models with an additional method factor to explicitly test whether there is a method effect induced by these items. All these models provided better fit than the models without a method factor. This raises questions about the use of negatively formulated items in questionnaires. If the method itself appears to have such an influence on the answers, maybe revision of these items should be considered. However, we agree with Gignac and colleagues (in press) that the existence of a method factor does not preclude the existence of a substantive EOT-factor.

Finally, we found no evidence of the assumed general alexithymia factor underlying the first-order factors. This is surprising given the theoretical view. However, when we look at the correlations between the first-order factors, we consistently see a very low correlation between DIF and EOT (or split into PR and IM). In model (e), the second-order model showed about equal fit than the first-order model. This is probably because of the fact that DIF and DDF are collapsed, and the items of DDF cause a substantial correlation with PR and IM. However, this model with DIF and DDF as one factor, and EOT split into PR and IM did not show a good fit in the first place, so it is not useful to continue investigating this model. Gignac et al. (in press) did not find support for a hierarchic model with alexithymia as second-order factor either. However, based on the very strict cutoff norms of Hu and Bentler (1999), they also rejected the three-factor model. As an alternative they defend the use of nested models, but theoretical bases for this technique seem questionable. In these models with general and narrow first-order factors, all items are supposed to load on the general alexithymia factor, but the factors (DIF, DDF, EOT PR-IM) that are theoretically considered dimensions of alexithymia are not considered to mediate these associations. This implies that other variance of the items is considered to be explained by general alexithymia than the variance explained by the alexithymia-dimensions. This also raises the question of which grounds are used to consider this general first-order factor as alexithymia. It might, for example, also be hypothesized as a negative affectivity factor, because negative affectivity is considered to influence answers on the TAS-20 (Lumley, 2000). Thus, although the nested models technique may be statistically correct, it leaves us without a frame of reference to interpret results (e.g., "How should we interpret a DIF-score separated from alexithymia?") and thus appears clinically not useful. We agree with Bagby, Taylor, Quilty, and Parker (in press) that these authors do not offer theoretical (nor empirical) grounds to defend this strategy.

However, the fact that a second-order factor for the two plausible models (d, e) appears not likely from our results does challenge the theory on alexithymia. It appears that it cannot simply be assumed that DIF and DDF on one side and EOT (or PR and IM) on the other are dimensions of one underlying construct. However, rather than immediately question the theory, it is worthwhile examining the possibility that this is because of measurement problems. Often self-report measures for a concept like alexithymia have been criticized. First, it is argued that it is paradoxical to ask people to judge a capacity they may lack (Waller & Scheidt, 2004). Second, answers on the TAS-20 are greatly influenced by negative affectivity (Lumley, 2000), and this influence is larger for the DIF and DDF subscales than for the EOT subscale. Consequently, one can wonder what we measure by means of the TAS-20, and especially with the DIF and DDF subscales. Future research should aim at including non-self-report methods to measure alexithymia to clear out the dimensionality of the concept. The recently developed Toronto Structured Interview for Alexithymia (Bagby, Taylor, Parker, & Dickens, 2006) seems a valuable instrument to include in research on this issue. First, it provides an alternative for the self-report measures and thus overcomes its reported weaknesses. Second, it is based not only on the same alexithymia definition as the TAS-20 but also includes questions that measure reduced fantasy and imaginal thinking (IMP), an aspect of alexithymia that was removed from the TAS because it appeared to be difficult to measure reliably by means of a Self-Report Scale (Bagby, Parker, et al., 1994). Preliminary research indeed showed four factors (facet scales: DIF, DDF, EOT, IMP) and two higher order domain scales (affect awareness: DIF + DDF; operative thinking: EOT + IMP) (Bagby et al., 2006); however, further research is necessary to confirm these results. In sum, studies including this instrument could solve problems with self-report measures and help clarify the issue of dimensionality of the alexithymia concept. In general, we agree with the authors of the TAS-20 that alexithymia should be measured using multiple methods.

There are some limitations to the present study. First, our student sample was somewhat small, which may affect the generalizability of our results for this group. This group was also rather homogeneous concerning age and social profile and consequently cannot be considered a good representative of the general population. Next, the greater number of women in both samples may pose limitations on the validity of these results for men. However, in the clinical sample, we believe the number of men was large enough to result in valid information. Also, concerning the bad fit of the second-order models (and the low correlations between DIF and DDF), influence of sample characteristics cannot be excluded. Furthermore, research, which includes different factor models, investigates the possibility of a method factor, and considers second-order models in clinical and nonclinical samples is thus indicated.

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