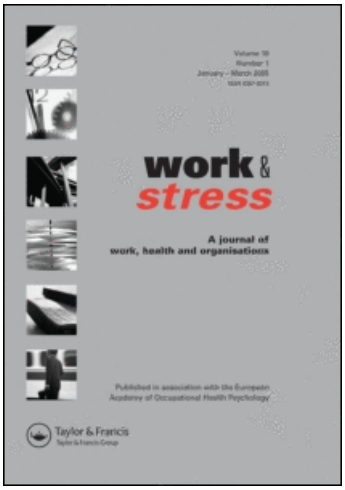

Work & Stress
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713697904

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To cite this Article Edwards, Jeffrey R. and Baglioni Jr, A. J.(1993) 'The measurement of coping with stress: Construct validity of the ways of coping checklist and the cybernetic coping scale', Work & Stress, 7: 1, 17 — 31
To link to this Article: DOI: 10.1080/02678379308257047
URL: http://dx.doi.org/10.1080/02678379308257047

WORK & STRESS, 1993, VOL. 7, NO. 1, 17–31

The measurement of coping with stress: construct validity of the Ways of Coping Checklist and the Cybernetic Coping Scale

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Keywords: Coping; Stress; Ways of Coping Checklist; Cybernetic Coping Scale; Construct validity.

Though numerous measures of coping have been presented in the literature, procedures used to evaluate the construct validity of these measures are incomplete, and few studies have examined multiple measures using data from the same sample. This study presents a comparative evaluation of the construct validity of the Ways of Coping Checklist (WCCL; Lazarus and Folkman 1984) and the Cybernetic Coping Scale (CCS; Edwards 1991), based on confirmatory factor analyses of data from 116 MBA students. Results provided moderate support for the CCS and weak support for the WCCL. Recommendations for the use of the WCCL and CCS are offered, and procedures for the development of coping measures are discussed.

1. Introduction

In recent years, research into coping with stress at work has gained considerable momentum (Edwards 1988). An important step in this research is the development of valid and reliable measures of coping (Cohen 1987). Though numerous measures have been proposed (e.g. Aldwin *et al.* 1980, Amirkhan 1990, Carver *et al.* 1989, Dewe and Guest 1990, Endler and Parker 1990, Latack 1986, McCrae 1984, Parasuraman and Cleek 1984, Vitaliano *et al.* 1985), choosing from among these measures is difficult for two reasons. First, procedures typically used to establish the construct validity of the measures (i.e. the degree to which they represent the intended underlying construct; Cronbach and Meehl 1955) are incomplete. Most studies report reliability coefficients for scales derived through exploratory factor analysis, perhaps supplemented by correlations with measures of mental and physical symptoms. These procedures provide incomplete and often ambiguous information regarding construct validity, because they fail to directly verify the presumed underlying measurement model (Bollen 1989). Second, few studies have compared multiple coping measures using data from the same sample. As a result it is impossible to distinguish actual differences in construct validity across measures from mere sampling variability.

The purpose of this article is to provide a comparative evaluation of two coping measures, the Ways of Coping Checklist (WCCL; Aldwin *et al.* 1980) and the Cybernetic Coping Scale (CCS; Edwards 1991). These measures are evaluated in terms of reliability, unidimensionality, and other core aspects of construct validity, based on confirmatory factor analysis of their hypothesized underlying measurement models. The article concludes with suggestions for the development of coping measures in job stress research.

0267–8373/93 $10·00

2. Scale origins and development

2.1. *The Ways of Coping Checklist*

The WCCL is based on Lazarus' transactional model of stress and coping (Lazarus, 1966, Lazarus and Folkman 1984, Lazarus and Launier 1978). Briefly, this model views stress as a relationship between the person and the environment that taxes or exceeds the person's resources and endangers his or her well-being. Coping is defined as the 'constantly changing cognitive and behavioural efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person' (Lazarus and Folkman 1984, p. 141). Two basic categories of coping include efforts to alter the troubled person–environment relationship (i.e. problem-focused coping) and efforts to regulate emotional distress (i.e. emotion-focused coping). Problem-focused coping includes defining the problem, generating, evaluating, and selecting potential solutions, and attempting to cognitively reappraise the situation by shifting level of aspiration, reducing ego involvement, finding alternative channels of gratification, or developing new standards of behaviour. Emotion-focused coping includes minimization, selective attention, avoidance, distancing, self-deception, positive comparisons, and reality distortion.

The WCCL contains 67 items drawn from existing measures (Sidle *et al.* 1969, Weisman and Worden 1976) and derived from the transactional model (Lazarus and Folkman 1984). These items were originally classified into two broad scales representing problem- and emotion-focused coping (Folkman and Lazarus 1980). However, subsequent factor analyses revealed that these scales were too general, collapsing multiple coping methods (Aldwin *et al.* 1980, Aldwin and Revenson 1987, Edwards *et al.* 1990, Folkman and Lazarus 1985, Folkman *et al.* 1986, Parkes 1984, Vitaliano *et al.* 1985). More specific scales derived from these analyses have yielded reliabilities ranging from 0·50 to 0·89, with approximately half exceeding the criterion of 0·70 (Nunnally 1978). However, these analyses also reveal that the factor structure of the WCCL is rather unstable, yielding anywhere from three to eight factors and loadings that vary considerably, such that items are assigned to different factors or dropped entirely from one analysis to another. This is partly attributable to the items comprising the WCCL, which often confound different coping methods (e.g. 'Didn't let it get to me; refused to think too much about it') or are inherently ambiguous, describing a behaviour with no indication of its focus or intent (e.g. 'I got professional help', 'I changed something about myself', 'I prayed'). This instability is also symptomatic of using successive exploratory factor analyses to verify a factor structure, which is better accomplished using confirmatory factor analysis (Bollen 1989, Hunter and Gerbing 1982, Long 1983).

2.2. *The Cybernetic Coping Scale*

The CCS was derived from Edwards' cybernetic theory of stress, coping, and well-being (Edwards 1988, 1992, Edwards and Cooper 1988). This theory views stress as a discrepancy between the individual's perceived state and desired state, provided the presence of this discrepancy is considered important by the individual. Coping is conceptualized as attempts to reduce or eliminate the negative effects of stress on well-being. Five forms of coping are identified, including attempts to bring the situation into conjunction with desires, adjust desires to meet the situation (i.e. accommodation), reduce the importance associated with the discrepancy (i.e. devaluation), improve well-being directly (i.e. symptom reduction), and direct attention away from the situation (i.e. avoidance). Hence, stress and coping are viewed as critical components of a negative feedback loop, in which stress damages well-being and activates coping, which may

improve well-being directly and indirectly, through the perceived and desired states comprising the discrepancy, the level of importance associated with the discrepancy, and the amount of attention directed towards the discrepancy.

The first version of the CCS was based on items drawn from existing coping measures (e.g. Aldwin *et al.* 1980, Billings and Moos 1984, Latack 1986, Pearlin and Schooler 1978, Sidle *et al.* 1969), which were substantially revised and supplemented in accordance with the five dimensions indicated by the cybernetic theory (i.e. changing the situation, accommodation, devaluation, avoidance, symptom reduction). The eight items that most clearly reflected each dimension were combined and administered to samples of MBA students, executives, and psychiatric inpatients. Confirmatory factor analyses yielded similar results across samples, but also indicated that certain factors were poorly represented, particularly accommodation and symptom reduction. Based on these results, additional items were written and evaluated for appropriateness of content by five judges. The eight items that best described each dimension, based on both statistical and conceptual criteria, were retained to form the second version of the CCS, which was used in the present study.

2.3. *The present study*

Available evidence indicates that the construct validity of the WCCL and CCS requires further examination. Several studies have reported exploratory factor analyses of the WCCL and reliability estimates and correlations for the resulting scales, but the obtained factor structures have varied considerably, and no study has directly examined the measurement model presumably underlying the WCCL. Analyses of the CCS have been somewhat more comprehensive, but results for the current version have not been reported. This study will evaluate and compare the construct validity of the WCCL and CCS, based on confirmatory factor analysis of their associated underlying measurement models.

3. Method

3.1. *Sample*

Surveys were distributed to 501 MBA students at a large business school in the eastern US. A total of 146 surveys were returned, with 116 providing usable responses on all measures. The final sample was predominantly male (73%) and averaged 27 years of age and slightly over 4 years job experience. Respondents did not differ from non-respondents in terms of gender, age, or years of job experience.

3.2. *Measures*

Measures included the 67-item WCCL presented in Lazarus and Folkman (1984, pp. 328–333) and the 40-item second version of the CCS. Following Lazarus and Folkman (1984), a four-point response scale was used for the WCCL ('Not used' to 'Used a great deal'), whereas a seven-point response scale was used for the CCS ('Did not use at all' to 'Used very much'). To reduce order effects, half the surveys presented the WCCL first, and the other half presented the CCS first. Measures were distributed at the conclusion of the recruiting season, when most respondents had completed their job search. For both measures, respondents were asked to indicate how they coped with problems in locating what they viewed as the ideal job. Following Folkman *et al.* (1986), eight WCCL scales were created, representing confrontive coping (six items), distancing (six items), self-control (seven items), seeking social support (six items), accepting responsibility (four items), escape-avoidance (eight items), planful problem-solving (six items), and positive

reappraisal (seven items). This scoring procedure was chosen because it is apparently the current method of choice among proponents of the Lazarus model (e.g. Folkman and Lazarus 1986, 1988, Folkman *et al.* 1986). Five eight-item CCS scales were created, representing changing the situation, acccommodation, devaluation, avoidance, and symptom reduction.

3.3. *Analysis*

To facilitate comparisons with earlier research, initial analyses consisted of calculating reliability estimates (Cronbach's alpha) and intercorrelations among the coping scales. Next, confirmatory factor analyses were conducted, examining item loadings, residuals, modification indices, correlations among the latent factors, and overall model fit.

4. Results

4.1. *Reliability and intercorrelations of the WCCL and CCS scales*

Table 1 presents reliability estimates and intercorrelations of the WCCL and CCS scales. Of the eight WCCL scales, only one (escape-avoidance) exhibited a reliability greater than 0·70, six ranged between 0·53 and 0·68, and one (confrontive coping) was less than 0·40. In contrast, all five CCS scales exhibited reliabilities greater than 0·70, and four were greater than 0·86. For the WCCL, the highest interscale correlation was between accepting responsibility and escape-avoidance which, based on interitem correlations, indicated a shared emphasis on putting the situation behind oneself. The confrontive coping and positive reappraisal scales were also highly correlated, but items with high correlations across these scales were too vague to allow precise interpretation (e.g. 'Took a big chance or did something very risky', 'I changed something about myself'). For the CCS the highest intercorrelation was between the accommodation and devaluation scales, which was attributable to two accommodation items that conveyed elements of minimizing the situation (i.e. 'I told myself the situation was okay after all', 'I tried to convince myself that the way things were was, in fact, acceptable'). The devaluation and avoidance scales were also highly correlated, which seemed to indicate that avoidance is probably preceded by deciding the problem is unimportant. The WCCL distancing scale was highly correlated with the CCS accommodation, devaluation, and avoidance scales. Further inspection revealed that these correlations were attributable to specific items in the distancing scale that suggested accommodation ('Looked for the silver lining, so to speak; tried to look on the bright side of things'), devaluation ('Made light of the situation; refused to get too serious about it'), and avoidance ('Tried to forget the whole thing'). The WCCL planful problem-solving scale was also highly correlated with the CCS changing the situation scale, apparently due to a shared emphasis on directing efforts towards the situation rather than the person.

4.2. *Confirmatory factor analysis*

As indicated earlier, the validation of coping measures typically relies on reliability estimates and correlations for scales derived through exploratory factor analysis. These procedures provide limited evidence for construct validity, for several reasons. First, reliability estimates can conceal low or even negative item loadings, conceptually distinct item subsets, sizeable item loadings on other factors, and other indicators of poor construct validity. Second, correlations between coping scales and other measures presume the validity of those measures as well as the strength of the relationship between the associated underlying constructs. Without independent evidence regarding these factors, correlations

Table 1. Descriptive statistics, correlations and reliability estimates for the CCS and WCCL

				CCS					WCCL							
		M	SD	1	2	3	4	5	1	2	3	4	5	6	7	8
CCS																
1.	Changing the situation	36·99	10·39	(0·898)	0·074	−0·288**	−0·314**	0.215*	0·726**	−0·497**	−0·169	0·243**	−0·158	−0·178	0·827**	0·403**
2.	Accommodation	30·23	8·81	−0·048	(0·779)	0·522**	0·391**	0·238**	0·047	0·541**	0·370**	0·234*	0·490**	0.424**	0·025	0·258**
3.	Devaluation	27·85	12·95	−0·272**	0·609**	(0·945)	0·548**	0·083	−0·172	0·665**	0·290**	−0·001	0·443**	0·370**	−0·350**	0·105
4.	Avoidance	22·77	10·59	−0·291**	0·407**	0·527**	(0·934)	0·249**	−0·199	0·851**	0·514**	−0·055	0·507**	0·608**	−0·385**	0·113
5.	Symptoms reduction	31·05	9·97	0·207*	0·176	0·085	0·218*	(0·863)	0·699**	0·013	0·001	0·653**	0·106	0·336**	0·108	0·324**
WCCL																
1.	Confrontive coping	5·30	2·64	0·399**	0·051	−0·025	−0·016	0·418**	(0·397)	−0·307**	0·097	0·780**	−0·024	0·034	0·831**	0·670**
2.	Distance	7·16	3·49	−0·391**	0·510**	0·562**	0·617**	0·006	0·002	(0·669)	0·786**	−0·070	0·550*	0·598**	−0·362**	0·155
3.	Self-control	10·16	3·65	0·051	0·244**	0·157	0·296**	0·157	0·327**	0·370**	(0·582)	−0·017	0·447**	0·521**	0·212	0·420**
4.	Seeking social support	8·35	3·78	0·315**	0·157	−0·024	−0·055	0·413**	0·396**	−0·043	0·305**	(0·648)	0·111	0·306**	0·384**	0·377**
5.	Accepting responsibility	3·58	2·46	−0·145	0·285**	0·302**	0·393**	0·137	0·159	0·307**	0·262**	0·200*	(0·539)	0·742**	−0·028	0·309**
6.	Escape-avoidance	6·59	4·20	−0·096	0·229*	0·301**	0·446**	0·315**	0·294**	0·291**	0·309**	0·254**	0·519**	(0·703)	−0·153	0·174
7.	Planful problem-solving	9·91	3·37	0·549**	−0·045	−0·214*	−0·241**	0·077	0·405**	−0·201*	0·338**	0·331**	−0·020	−0·009	(0·595)	0·634**
8.	Positive reappraisal	7·47	3·93	0·307**	0·250**	0·156	0·152	0·331**	0·503**	0·220*	0·398**	0·336**	0·196*	0·247**	0·407**	(0·678)

Note: n=116. Reliabilities (Cronbach's alpha) are reported along the diagonal. Values below the diagonal are simple scale correlations; values above the diagonal are correlations from a 13-factor multi-item measurement model estimated using LISREL.
*$p<0·05$; **$p<0·01$.

between observed measures provide ambiguous information regarding construct validity (Bollen, 1989). Finally, exploratory factor analysis provides only a rough indication as to whether the constructs of interest are evident in the data, because the obtained factor structure is derived empirically, not on theoretical grounds. Obviously, it is difficult to evaluate construct validity when the factor structure corresponding to those constructs cannot be posited *a priori*.

The preceding limitations can be overcome with confirmatory factor analysis, which allows direct assessment of a hypothesized measurement model. Of the numerous procedures used to evaluate these models (Anderson and Gerbing 1988, Bollen 1989, Gerbing and Anderson 1988, Hunter and Gerbing 1982, Joreskog and Sorbom 1989, Long 1983), the following are essential for establishing construct validity. First, each item assigned to a factor should load significantly only on that factor. The magnitude of this relationship provides a direct representation of the construct validity of the item in question (Bollen 1989, Cronbach and Meehl 1955, Schwab 1980). Second, items loading on the same factor should conform to the product rule for internal consistency, which states that their correlation should equal the product of their respective factor loadings.[1] This simply means that, if two items represent the same construct, their relationship should be completely determined by their associations with that construct (Danes and Mann 1984, Gerbing and Anderson 1988). Third, items loading on different factors should conform to the product rule for external consistency, meaning that their correlation should equal the product of their factor loading times the correlation between their respective underlying factors. In other words, the relationship between two items representing different constructs should be completely determined by the relationship between those constructs and the degree to which each item represents its associated construct (Danes and Mann 1984, Gerbing and Anderson 1988). Fourth, measurement errors for all items should be uncorrelated. That is, if the measurement model is correctly specified, there should be no extraneous factors inducing systematic covariance between items, leaving only random (i.e. uncorrelated) error (Gerbing and Anderson 1984, Lord and Novick 1968). Uncorrelated measurement errors and internal and external consistency are required for unidimensional measurement, which is critical but often overlooked element of construct validity (Hattie 1985, Hunter and Gerbing 1982).

Measurement models for the WCCL and CCS were analysed using LISREL VII (Joreskog and Sorbom 1988). Standardized item loadings and fit indices are reported in tables 2 and 3, and correlations among the latent factors obtained from a full 13-factor measurement model are reported in table 1. Both models yielded a significant chi-square, indicating that neither model fitted the data. However, chi-square has several limitations, such as sensitivity to sample size (Bentler and Bonett 1980). We examined five additional fit indices; two of these, the goodness-of-fit index (GFI) and adjusted goodness-of-fit index (AGFI; Joreskog and Sorbom 1988), represent the fit of the model to the covariance matrix for the observed variables, with the latter correcting for the number of parameters estimated. Though widely used, these indices are also sensitive to sample size (Anderson and Gerbing 1984, Marsh *et al.* 1988) and do not specifically reflect the proportion of *covariation* among the observed variables explained by the model, which is the aim of most investigations (James *et al.* 1982, Mulaik *et al.* 1989). Hence, the Type 2 Normed Fit Index (NFI2) and Type 2 Parsimonious Normed Fit Index (PNFI2) were also calculated, which represent the proportion of the covariation among the observed variables accounted for by the model, the latter correcting for the number of parameters used (Mulaik *et al.* 1989). Finally, the Tucker–Lewis Index (TLI; Tucker and Lewis, 1973) was calculated, which also indicates incremental model fit and is relatively insensitive to sample size (Anderson

Table 2. Confirmatory factor analysis of the WCCL

	Item loading
(1) *Confrontive coping*	
6. I did something which I didn't think would work, but at least I was doing something.[2,3,5,6,8]	−0·155
7. Tried to get the person(s) responsible to change his or her mind.	0·279**
17. I expressed anger to the person(s) who caused the problem.	0·061
28. I let my feelings out somehow.[4,6,7]	0·436**
34. Took a big chance or did something very risky.	0·342**
46. Stood my ground and fought for what I wanted.[6,7]	0·750**
(2) *Distancing*	
12. Went along with fate; sometimes I just have bad luck.	0·380**
13. Went on as if nothing had happened.	0·616**
15. Looked for the silver lining, so to speak; tried to look on the bright side of things.[1,3,4,7,8]	0·431**
21. Tried to forget the whole thing.[5,6]	0·569**
41. Didn't let it get to me; refused to think about it too much.[5,6]	0·611**
44. Made light of the situation; refused to get too serious about it.[4,5,6]	0·417**
(3) *Self-controlling*	
10. Tried not to burn my bridges, but leave things open somewhat.[1,4,7,8]	0·136
14. I tried to keep my feelings to myself.[1,8]	0·559**
35. I tried not to act too hastily or follow my first hunch.[1,4,7,8]	0·350**
43. Kept others from knowing how bad things were.[1,4]	0·610**
54. I tried to keep my feelings from interfering with other things too much.[7]	0·539**
62. I went over in my mind what I would say or do.[1,2,4,7,8]	0·235*
63. I thought about how a person I admire would handle the situation and used that as a model.[1,2,4,7,8]	0·180
(4) *Seeking social support*	
8. Talked to someone to find out more about the situation.[1,3,7,8]	0·408**
18. Accepted sympathy and understanding from someone.[5]	0·642**
22. I got professional help.[5,6]	0·150
31. Talked to someone who could do something concrete about the problem.[1,7,8]	0·268**
42. I asked a relative or friend I respected for advice.[1,2]	0·635**
45. Talked to someone about how I was feeling.[2,3,5,6]	0·730**
(5) *Accepting responsibility*	
9. Criticized or lectured myself.[4,6]	0·366**
25. I apologized or did something to make up.	0·289**
29. Realized I brought the problem on myself.[6]	0·499**
51. I made a promise to myself that things would be different next time.	0·761**
(6) *Escape-avoidance*	
11. Hoped a miracle would happen.	0·633**
16. Slept more than usual.	0·312**
33. Tried to make myself feel better by eating, drinking, smoking, using drugs or medication, and so forth.[5]	0·370**

Table 2—*Continued*

	Item loading		Item loading
40. Avoided being with people in general.[7]	0·416**	49. I knew what had to be done, so I doubled my efforts to make things work.	0·675**
47. Took it out on other people.[2,3]	0·403**	52. Came up with a couple of different solutions to the problem.[5]	0·485**
50. Refused to believe that it had happened.[2,3]	0·377**		
58. Wished that the situation would go away or somehow be over with.[1,4,7,8]	0·667**		
59. Had fantasies or wishes about how things might turn out.	0·567**		
(7) *Planful problem-solving*		(8) *Positive reappraisal*	
1. Just concentrated on what I had to do next—the next step.	0·330**	20. I was inspired to do something creative.[6,7]	0·393**
26. I made a plan of action and followed it.	0·594**	23. Changed or grew as a person in a good way.[3]	0·701**
39. Changed something so things would turn out all right.	0·451**	30. I came out of the experience better than when I went in.	0·760**
48. Drew on my past experiences; I was in a similar situation before.	0·199	36. Found new faith.[2,5,6]	0·398**
		38. Rediscovered what is important in life.[6]	0·299**
		56. I changed something about myself.[1,7]	0·613**
		60. I prayed.[2,3,6,7]	0·207*

$\chi^2 = 2091{\cdot}12^{**}$; df = 1147; GfI = 0·601; AGFI = 0·556; NFI2 = 0·469; PNFI2 = 0·439; TLI = 0·407.

Note: Table entries are standardized factor loadings. For each item, numerical superscripts indicate the factor(s) for which that item yielded a significant modification index ($p < 0{\cdot}05$).
$^{*}p < 0{\cdot}05$; $^{**}p < 0{\cdot}01$.

and Gerbing 1984. Marsh *et al.* 1988). Critical values of these indices are somewhat arbitrary (Bentler and Bonett 1980, Marsh *et al.* 1988, Wheaton 1987), but values of 0·90 or greater are typically considered acceptable for the GFI, AGFI, NFI2, and TLI (no critical value for the PNFI2 has been established). Results indicated that neither model met the criterion of 0·90, though the CCS fared notably better than the WCCL.

Examining item loadings for the WCCL (Table 2) revealed that four of the eight factors contained items with non-significant loadings, indicating that these items did not adequately represent the intended underlying factor. Furthermore, 35 of the 50 items yieled significant modification indices ($p<0·05$) for loadings on at least one other factor (meaning that the fit of the model would improve significantly if the item were allowed to load on those factors; see Sorbom 1975), and 14 of these items yielded significant indices on three or more factors. For example, item 62 ('I went over in my mind what I would say or do') not only loaded on the self-controlling factors, but also yielded significant modification indices for the confrontive coping, distancing, social support, planful problem-solving, and positive reappraisal factors. This apparently reflects the inherent ambiguity in this item, which does not specify the content of what was mentally rehearsed. In contrast, all CCS items loaded significantly on the intended factor (Table 3). Fifteen of the 40 items yielded significant modification indices for other factors, with two items yielding significant indices on three factors. Again, this suggested ambiguity in item content (e.g. 'I tried to change the things about the situation that were bothering me').

Product rules for internal and external consistency were tested by examining standardized residuals, which indicate whether the correlation between a pair of items is significant after taking the hypothesized measurement model into account (Joreskog and Sorbom 1988). Internal consistency was evaluated by examining residuals within each factor, and external consistency was evaluated by examining residuals between factors. For these tests a probability level of 0·01 was used (Joreskog and Sorbom 1988). Of the eight WCCL factors, only three exhibited significant within-factor residuals. In contrast, all eight factors exhibited significant between-factor residuals, but the proportion of significant residuals was modest, ranging from 14/264 for planful problem-solving to 33/264 for seeking social support.[2] As expected, the largest residuals were found for items sharing similar content that were assigned to different factors (e.g. 'I let my feelings out somehow' and 'Talked to someone about how I was feeling'; 'Kept others from knowing how bad things were' and 'Avoided being with people in general'). Unlike the WCCL, all five CCS scales exhibited significant within-factor residuals, ranging from 1/28 for changing the situation to 8/28 for accommodation. The residuals for the accommodation factor corresponded to several item pairs sharing specific content that was not explained by the common underlying factor (e.g. 'I tried to accept the situation as it was' and 'I tried to just accept things as they were'). As with the WCCL, all five CCS factors exhibited a modest proportion of significant between-factor residuals, ranging from 13/256 for avoidance to 41/256 for accommodation. Again, these residuals represented items with similar content assigned to different factors (e.g. 'I told myself the situation was okay after all' and 'I told myself the problem wasn't so serious after all'). Overall, of the 1225 residuals tested for the WCCL, 99 were significant (8·1%), whereas 74 of the 780 residuals tested for the CCS were significant (9·5%).

Correlations among measurement errors were not directly tested, because both measurement models fixed these correlations at zero (Gerbing and Anderson 1984, Lord and Novick 1968). Instead, modification indices for parameters representing these correlations were examined, indicating the degree to which the fit of the model would improve if a given pair of errors were allowed to correlate. For both models, modification

Table 3. Confirmatory factor analysis of the CCS

	Item loading
(1) *Changing the situation*	
1. I tried to change something about the situation so things would turn out.	0·675**
10. I tried to bring about what I thought should happen.[2,4]	0·658**
14. I made a plan of action to change the situation and followed it.	0·607**
18. I tried to change the situation to get what I wanted.	0·760**
22. I tried to change the things about the situation that were bothering me.[2,4,5]	0·688**
26. I focused my efforts on changing the situation.	0·813**
35. I worked on changing the situation to get what I wanted.	0·765**
39. I tried to fix what was wrong with the situation.	0·856**
(2) *Accommodation*	
6. I told myself the situation was okay after all.[3,4]	0·328**
15. I tried to adapt to the situation.[3,5]	0·375**
17. I tried to accept the situation as it was.[3]	0·300**
19. I tried to just accept things as they were.[1,3]	0·261**
23. I made an effort to change my expectations.	0·754**
27. I tried to convince myself that the way things were was, in fact, acceptable.[3]	0·447**
31. I tried to adjust my expectations to meet the situation.[1]	0·852**
40. I tried to adjust my own standards.	0·816**
(3) *Devaluation*	
3. I tried to convince myself that the problem was not very important after all.	0·871**
7. I told myself the problem was unimportant.	0·838**
11. I tried to convince myself that the problem was, in fact, pretty insignificant.	0·838**
20. I told myself the problem wasn't so serious after all.	0·869**
24. I told myself the problem wasn't worth worrying about.[4]	0·814**
28. I told myself the problem wasn't such a big deal after all.	0·937**
32. I tried to convince myself that there were other things in life that were more important.[2,5]	0·657**
36. I told myself the problem was not very important in the grand scheme of things.	0·791**
(4) *Avoidance*	
4. I tried to keep myself from thinking about the problem.	0·738**
8. I tried to turn to my attention away from the problem.	0·798**
12. I tried to just forget the whole thing.[1,5]	0·835**
16. I tried to think about other things.	0·789**
25. I refused to think about the problem.	0·770**
29. I tried to keep my mind off the problem.[5]	0·827**
33. I tried to simply ignore the problem.[2,3,5]	0·790**
37. I tried to avoid thinking about the problem.[2]	0·874**
(5) *Symptom reduction*	
2. I tried to just let off steam.	0·688**
5. I tried to let my feelings out somehow.	0·624**
9. I did something that I thought would soothe my nerves.	0·652**
13. I tried to relieve my tension somehow.	0·735**
21. I did something I enjoyed, just to make myself feel better.	0·584**
30. I tried to just get it off my chest.	0·734**
34. I tried to just calm down.[4]	0·646**
38. I just tried to relax.	0·662**

$\chi^2 = 1303{\cdot}85^{**}$ df = 730; GFI = 0·652; AGFI = 0·609; NFI = 0·815; PNFI = 0·762; TLI = 0·799.

Note: Table entries are standardised factor loadings. For each item, numerical superscripts indicate the factor(s) for which that item yielded a significant

indices for within-factor measurement error correlations exactly paralleled the within-factor residuals, such that every pair of items yielding a significant residual also yielded a significant modification index ($p<0{\cdot}01$). This is not surprising, because the residual between any within-factor item pair can be eliminated by allowing their measurement errors to correlate. All eight WCCL factors yielded significant modification indices for between-factor correlated errors, though the proportion of significant indices was small, ranging from 4/264 for planful problem-solving to 11/264 for seeking social support. For the CCS, significant indices were found for all factors except devaluation, and the proportion of significant indices was again small, ranging from 4/256 for avoidance to 9/256 for symptoms reduction. Though not identical, these results closely paralleled the pattern of residuals for both models, such that significant modification indices were usually accompanied by a significant residual.

Several other results pertaining to the WCCL and CCS measurement models are worth noting. The first concerns the within-factor variation in item loadings for the WCCL and CCS. When unweighted items are summed to form a scale (as in the present case), it is desirable for these items to be tau equivalent, meaning that they equally represent the intended underlying factor (Novick and Lewis 1967, Nunnally 1978). Inspection of tables 2 and 3 reveals considerable variation in item loadings for the WCCL factors, whereas all but the accommodation factor for the CCS exhibited fairly consistent loadings. Nonetheless, tests for tau equivalence (Joreskog and Sorbom 1988) supported the WCCL distancing, self-controlling, and escape-avoidance factors, but did not support any of the CCS factors, even though the average range of item loadings was larger for the three WCCL factors than for the CCS factors. Further inspection revealed that the standard errors for item loadings were notably higher for the WCCL than for the CCS items, making it more difficult to demonstrate tau equivalents for the CCS. Second, correlations between the WCCL confrontive coping and planful problem-solving factors and the distancing and self-controlling factors did not differ significantly from unity, indicating that, after controlling for measurement error, these factors were essentially redundant (Singh 1991).

5. Discussion

The results of this study provide moderate support for the construct validity of the CCS and little support for the construct validity of the WCCL. Reliability estimates for the WCCL scales were generally low, with none reaching the criterion of 0·70. The hypothesized measurement model provided a poor fit to the data, all item loadings were significant for only four of the eight factors, and 35 of the 50 items yielded significant modification indices for loadings on other factors. Nonetheless, the proportion of significant residuals was rather modest, and there was little evidence of correlated measurement error. In contrast, reliability estimates for the CCS were notably higher, ranging from 0·779 to 0·945. However, the hypothesized measurement model did not fit the data, even though all item loadings were significant and, for the most part, large in magnitude. Further analyses indicated that the lack of fit was attributable to residuals dispersed throughout the model, most of which indicated shared specific item variance not accounted for by the measurement model.

Given that the CCS was superior to the WCCL in terms of reliability, item loadings, and overall fit, it seemed odd that the CCS measurement model yielded a slightly higher proportion of significant residuals. One explanation is that the proportion of significant interitem correlations was over twice as large for the CCS as for the WCCL (42·7% vs.

17·0%). Because a residual is typically smaller in absolute magnitude than the corresponding correlation, it is unusual to obtain a significant residual when the corresponding correlation is not significant.[3] Hence, the relatively small proportion of significant residuals for the WCCL may be attributable, in part, to the small proportion of significant correlations among the WCCL items.

Based on these results it is difficult to recommend the use of the WCCL in its current form. These results are not entirely surprising, because the WCCL items represent numerous specific coping methods, with little evidence of conceptually homogeneous item subsets. Hence, subscales based on these items necessarily contain relatively little common item variance and, as a result, will yield low reliabilities and item loadings. These results also reflect the failure to refine the WCCL scales through successive confirmatory factor analyses, thereby rendering a given factor structure susceptible to chance sample fluctuations. The construct validity of the WCCL scales is further threatened by their rather weak correspondence with the coping dimensions outlined in the transactional model. For example, Lazarus and Folkman (1984) state that problem-focused coping includes problem definition, generating and evaluating alternative actions, and implementing the chosen action. Are these dimensions collectively represented by the planful problem-solving scale? If so, it is obviously unwise to collapse them within a single measure, unless their conceptual distinctions are irrelevant. Similarly, items representing the dimensions of emotion-focused coping described by Lazarus and Folkman (1984) are scattered throughout the WCCL scales, rendering their correspondence with the transactional model rather tenuous.

The current version of the CCS presents several problems as well, most notably highly specific content shared by certain items and redundancy in items comprising the accommodation and devaluation scales. However, the changing situation, avoidance, and symptom reduction scales demonstrated reasonable psychometric properties and seemed to adequately represent the intended underlying constructs. Furthermore, by dropping the flawed items from the accommodation and devaluation scales and retaining the four best items from each scale (see table 3), a 20-item CCS may be formed. Confirmatory factor analysis of the associated measurement model indicated somewhat better fit than for the full 40-item CCS (values for fit indices ranged from 0·796 for the AGFI to 0·957 for the NFI2), and reliabilities for all scales were 0·79 or higher. However, because the 20-item CCS was derived empirically, this information should be considered tentative, pending cross-validation. Furthermore, a third 40-item version of the CCS is currently being developed, which should yield additional improvements over both versions analysed. Until the third version is available, the 20-item CCS is recommended, given that it appears to provide a parsimonious and valid representation of the coping dimensions outlined by the cybernetic theory with little loss of information over the full 40-item CCS.

In sum, the present study provides moderate support for the construct validity of the CCS and weak support for the construct validity of the WCCL. This study also suggests that procedures typically used to develop coping measures, which rely on reliability estimates and correlations for scales derived through exploratory factor analysis, provided limited information regarding construct validity. Furthermore, because these procedures generate scales based on statistical rather than conceptual criteria, they are unlikely to yield adequate measures of the intended theoretical constructs. Future efforts to develop coping measures will be greatly facilitated by clearly defining the relevant coping dimensions, generating multiple items that convincingly represent these dimensions, and evaluating the resulting measure using confirmatory procedures such as those illustrated here.

Notes

1. Coefficients alpha is often considered an index of internal consistency. This is partly a misnomer, because alpha depends solely on the number of items on a scale and the average inter-item correlation (Nunnally 1978), neither of which indicate that internal consistency has been established. For this reason alpha should not be considered an index of unidimensionality (Green *et al.* 1977, Hattie 1985).
2. The denominators for these ratios indicate the total number of residuals tested for a given scale, which corresponds to the total number of correlations between the items comprising that scale and the remaining items in the measure.
3. This was verified in the present data, where 80% of the significant residuals were accompanied by a significant inter-item correlation.

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Submitted 10 October 1991
Accepted 28 July 1992