A computer-assisted self-monitoring procedure for assessing stress-related behavior under real life conditions

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Introduction

Investigations of the psychological aspects of coping with stress have to date, been based mainly on *self-report data*. A variety of procedures have been used to investigate stress coping. These include completing *questionnaires* with hypothetical situations, eliciting narrative accounts or structured protocols in which subjects describe their experiences during stressful episodes (e.g. diary methods; see Weber & Laux, 1987; Fisher & Elder, 1990). In some questionnaires (S-R questionnaires) hypothetical situations are presented and subjects are asked to describe how they would react.

Previous questionnaires investigating psychological stress and modes of coping with stress, traded their high economy for an uncertain validity. Validity and reliability of retrospective self-report data are impaired by memory errors and specific biases such as interferences of the actual mood with memory processes (mood-congruent memory processes; Blaney, 1986) or attributional tendencies (the critical reappraisal of retrospective reports of Brewin, Andrews and Gotlib (1993) concerns important critical life events and not daily episodes).

If it is general self-descriptions of their own reaction tendencies in stressful situations, rather than concrete episodes of the past which are at stake, the subject's responses to the questionnaire may indicate characteristics of his or her cognitive self-representation, rather than of his real behavior (cf. Ericson & Simon, 1980). They may depict self-concepts of coping behavior rather than real experienced behavior, especially if there is a large time lag between the stress encounters and their description in a questionnaire or interview. For some psychopathological groups this effect may be particularly strong.

Horowitz and Wilner (1976) analyzed coping behavior via *systematic observation of psychological features* by trained observers. They studied the reactions to real stressors under experimental conditions. Zeitlin (1980) observed coping behavior in real situations, and Hänggi and Schedle (1987) made systematic observations using hypothetical situations. The *observation of physiological characteristics* of stress and coping behavior has used all three types of situations as well: Hypothetical situations, laboratory situations with real or filmed stressors, and real life situations.

The different methods used to record the psychological and physiological characteristics of coping behavior can be summarized in the following matrix, which differentiates between the data sources and the setting of the study, respectively the way the situation is presented.

Table 1: Matrix of situations and data sources for the recording of stress and coping behavior (examples of publications)

Situations / Data sources	Hypothetical situations	Laboratory situations with real or filmed stressors	Real life situations in the field
Self-description	Krohne, Rösch & Kürsten, 1985 Becker, 1984a Reicherts & Perrez, 1993 (SCPQ; UBV)	Krohne, 1986 Lazarus et al., 1963	Folkmann & Lazarus 1980 Folkmann & Lazarus 1980 (WC) Braukmann & Filipp, 1983 (SEBV; German version of the WC)
External observation of psychological characteristics		Horowitz & Becker, 1971 Horowitz & Wilner, 1976 Scherer et al., 1985	Mechanic, 1962 Zeitlin, 1980
External observation of physiological characteristics	Lang et al., 1983 Hänggi & Schedele, 1987	Lazarus et al., 1962 Otto, 1991 Scherer et al., 1985	Fenz & Epstein, 1962 Margraf, 1990 Fahrenberg, 1994

Record units, goals and general characteristics of the computer-assisted self-monitoring procedure

The assessment method of Pawlik and Buse (this volume) inspired us to develop the COM-RES method (COMputer-assisted REcording System) for monitoring stress-related behavior under real life conditions (Perrez & Reicherts, 1987; 1989). General self descriptions or retrospective reports are replaced by a systematic self-monitoring procedure by trained self-observers. This assessment approach reduces the time lag between event and its recording to a minimum. Furthermore it permits an ambulatory self-observation under naturalistic conditions (Perrez, 1994).

The theoretically determined *record units* are stressful episodes in daily life. According to Lazarus (1966), stress and coping episodes are real events precipitated either externally or internally which make demands on the psychological system of the individual, and which are interpreted and worked-out via this system. Such episodes have a temporal structure that begins with a disturbance of the homeostasis and is followed by attempts to re-establish psychological equilibrium. The episodes are not limited to daily hassles. Macro-events such as critical life events are also experienced in a repeatedly interrupted sequence of discrete micro-events in the form of more or less short-term episodes. The macro-event 'generates' this sequence of micro-events belonging to the same

problem, but which can be psychologically very heterogeneous concerning their demands for adaptive responses, according to the nature of the concrete coping task. Episodes 'as elements of critical life events' are distinguished from 'episodes as daily hassles' by their stronger negative valence and by their membership to the family of events generated by the critical life event. Their individual organization has the same structure. Whether an event in daily life is a candidate for the protocol depends on the subjective evaluation and judgment of the subject.

The *goals* in the development of a method for computer-assisted self-monitoring under field conditions were: (1) The procedure should allow assessment of stressful episodes in daily life. (2) The time lag between the stressful event and its storing by the pocket computer should be reduced to a minimum, in order to limit memory distortion. It should facilitate the recording of information when the subject is still in the state of emotional arousal ('hot cognitions'). (3) The method should assess psychologically relevant data, not by a free self-description, but in a structured way according to a theoretical framework. (4) The procedure should enable the assessment of the relation of concrete stressful episodes with earlier stored episodes.

Table 2: Variables of the COMRES self-monitoring system for stressful episodes

Topic	Type of input	Rating levels	
Characterization of the episode:			
episodic structure (initial vs. subseq. situation)	categorical	2	
short description	text	-	
Appraisal of situation characteristics:			
controllability		6	(0;5)
changeability		6	(0;5)
negative valence	scales	6	(0;5)
ambiguity		6	(0;5)
probability of reoccurrence		6	(0;5)
familiarity		6	(0;5)
duration		5	(0;4)
Emotional reactions:			
profile with 6 dimensions	scales	6	(0;5)
(anxious/nervous, depressed, aggressive, hesitant,	text	-	
lethargic, abandoned) additional description			
(optional)			
Goal(s) of coping	*text*	-	
Self-directed coping behavior:			
search for information		3	(0;2)
suppression of information		3	(0;2)
re-evaluation	scales	3	(0;2)
palliation		3	(0;2)
self-blaming		3	(0;2)
other-blaming		3	(0;2)
Environment-directed coping behavior:			
active influence on stressor		3	(0;2)
evasion (escape, avoid)		3	(0;2)
passivity (hesitate, wait)	scales	3	(0;2)
help from others		3	(0;2)
additional description of active influence	text	-	
Coping efficiency (to date):			
problem solving	scales	3	(0;2)
discrepancy ideal/real behavior		3	(0;2)
Representativeness of behavior	scales	4	(0;3)
Attribution of outcome:			
internal		4	(0;3)
external (persons)	scales	4	(0;3)
external (circumstances)		4	(0;3)
Time and date	text	-	

The provisions made for achieving these goals were as follows: The pocket computer we use is about the size of a note pad (18 x 7x 1.5 cm). It can be carried around during everyday activities, and allows the immediate entry of information after a stressful episode or even during the episode. Though the latter is not always feasible, experience shows that in most cases it is possible. Thus, the time-span between the event and the assessment thereof is reduced, and cognitive distortions are kept at a minimum.

The self-monitoring procedure is structured according to psychologically relevant features (see Perrez & Reicherts, 1992). The same variables and constructs underlie the 'Stimulus-response process questionnaire' (UBV; Reicherts & Perrez, 1993) that includes dimensions such as: appraisal of stressors, stress emotions, goals in stressful situations, coping reactions, and causal attributions.

COMRES starts with a free description of the stressful event, and is followed by the scaled

subjective assessment of the stressors appraisal, according to criteria of *valence, controllability, changeability, ambiguity, probability of reoc-currence* and *familiarity* with the stressor. The subject's goal in the stressful situation can be freely described. Further, the subject is asked to record particular stress emotions. Concerning the coping responses the method differentiates between *self-directed* coping reactions (search for information, information repression, pallia-tion, re-evaluation, reframing, inner other blaming, and self-blaming), and *environment-directed* coping reactions (evasion, passivity, active influence, seeking for support of others). Finally, data on coping efficiency (goal attain-ment, discrepancy between actual and ideal be-havior), representativeness of one's behavior, and causal attribution for failure or success (see Table 2), are also recorded.

Sequences of episodes belonging to the same problem (e.g. resulting from a critical life event) can be assessed with respect to their interrela-tion over longer time periods. Episodes belong-ing to the same conflict i.e., which reoccur sev-eral times during the observation period can be represented with their interconnections by the system. Paper and pencil diaries have the disad-vantage that the accessibility of earlier written information may produce consistency artifacts (e.g. Auhagen, 1987; Feger & Auhagen, 1987).

Technical features of the COMRES

The above-mentioned goals and determinations require (1) a simple, easy-to-use recording and rating system for the description and judgment of the most important characteristics of the re-spective stress situation and events, and (2) a system of categories for describing self- and environment- directed attempts at coping.

Development of the computer program was oriented by criteria of software ergonomy (e.g., simple, user-friendly), safety of data entry and recording, economic memory organization, and work speed. Of major importance was the structuring of the user interface: once the pro-gram has been started, it presents the subject

with a series of questions to be worked through using multiple choice answers.

The pocket computer has a somewhat limited display with only four text lines. To avoid data entry errors questions are present together with a numbered scale. The textual equivalent of the answer given is then shown on the computer display. This can then be corrected or con-firmed. A 'help' key allows the user to view the respective scale on the computer display at all times during the assessment. A particular prob-lem was finding a structure flexible enough to allow users to describe their subjectively ap-praised relationship of an episode to an earlier stored episode. For this purpose, we chose a program structure with which previously re-corded descriptions could be reviewed (roll back) and the new situation linked to the earlier one by a special marking sequence. In this way sequences of interrelated episodes can be stored and reconstructed. The program is written in BASIC.

User training and type of behavior sampling

The application of COMRES requires training of the subjects in this particular method of self-monitoring. The users are not naive, but quali-fied self-observers. The training consists (1) of an introduction in the meaning of the underlying constructs (e.g. "evasion" or "search for infor-mation") and the items presented by the pro-gram; (2) of an introduction of the (simple) use of the pocket computer; (3) of an exercise of recording by the aid of three or four fictive or real episode with assistance of the trainer and by the help of a user Manual (Reicherts, Perrez & Matathia, 1986), and (4) of the application of the learned procedure in real life situations with the possibility of help (by telephone) during the evenings of the first week of self-observation. The general instruction to use the self-assessment computer was "Whenever You feel stressed, affected, excited or disturbed, try to record the situation directly on the computer !"

The sampling method focuses on every rele-vant event during four to five weeks. This

event-sampling method could be replaced or supplemented by a time-sampling procedure. Schwenkmezger and Schmitz-Friedhoff (1987; Schwenkmezger & Hank, 1993) or El-Giamal (1994) use a time sampling method for their self-monitoring procedure to record ongoing activities and stressful events.

Evaluation and methodological characteristics of COMRES

The following methodological questions have been studied with a sample of 60 subjects:
1. reliability of the method
2. reactivity effects, and
3. influence of 'social desirability' on the recording.

Subject sample and data collection

The sample consisted of 60 adults, 30 males and 30 females. the mean age was 26.0 years (s=4.4). The subjects were all university students; 80 % were unmarried. About 22% of subjects lived alone, 27% with their partner or spouse, 5% with relatives, 43% shared an apartment with others, and 3% had other living arrangements.

About 73% of the sample reported having no somatic symptoms or diseases, 18% slight symptoms or diseases. The remaining 9% of subjects had either strong or very strong symptoms or diseases. On their psychological health status, about 27% reported experiencing no present problems, 52% had slight problems, and 21% had pronounced problems. Thus, all in all, we were dealing with a typical (advanced) student population in central Europe. The subjects were recruited from among students at the University of Fribourg and Bern (Switzerland). They received Sfr. 50.- for their participation.

The subjects were trained to use the system on the basis of the user's manual. They were also instructed to record at least 30 episodes.

A total of 2381 episodes were recorded by the subjects, the mean number per subject was nearly 40 episodes during 4 to 5 weeks of self-observation. These episodes are very differ-ent. Examples, themes and types of episodes are presented in the result section.

Reliability

The calculation of the split-half reliability coefficients bases on the COMRES variables of the initial episodes only. This refers to events which had – according to the subject – no links to previously recorded stressful episodes. Initial episodes were numbered sequentially, divided odd-even, and the mean values for the two halves were calculated. The mean values of the even and odd episodes were then correlated, and the correlations were enhanced using the Spearman-Brown formula. Calculation of the split-half reliability values in this way was necessary because of the different actual events and the varying number recorded by the individual subjects (cf. Pawlik & Buse, 1982). This reliability test measures cross-situational stability, i.e., *consistency*, of the person's stress and coping behavior.

The mean reliability (after z transformation) for all COMRES variables was r_{tt}=.85 for the average 30.3 episodes. As expected, the consistency was somewhat smaller for the more context-dependent variables in environment-oriented coping (activity, passivity, evasion, social support) and for the attribution tendencies (own behavior, behavior of others, circumstances), the mean r_{tt} being .77 and .81 respectively (see for example McCrae, 1989). Here, the situation variance had a greater effect than in the case of emotions (mean r_{tt}=.85), situation appraisal (.87), or self-directed coping behavior (.87). Yet, since we are dealing here with the self-observations and self-perceptions from very heterogeneous stress situations for each subject,

the consistency may generally be considered satisfactory. The same is true for *stability* over time.

Reactivity

The possibility that self-observation of one's own reaction toward psychological stress over a period of several weeks, can have an influence on the behavior in question cannot be ruled out. The subject may learn to perceive important aspects of his or her behavior in such situations in a better and more precise fashion, which may then influence the cognitive structure in the way suggested by Schroder, Driver, and Streufert (1967) and lead to modified information pro cessing.

In order to test for reactivity, the recorded episodes were divided in half according to their temporal rank in the episode sequence. Thus episodes of the first protocol half were aggregated and compared with the aggregated episodes of the second part of the sequence. The variances of the first vs. second half were analyzed for each variable (see Table 3, columns on the right side).

The results point to relatively few changes overall during the course of the period of self-

Table 3: COMRES reliability and reactivity over time (all r_{12} p<.001)

	M_1 odd	M_2 even	s_1	s_2	r_{12}	r_{tt}	M_{t1} half 1	M_{t2} half 2	s_{t1}	s_{t2}	time F
Appraisal of situation characteristics:						(.87)					
controllability	2.71	2.85	.58	.60	.66	.80	2.82	2.73	.58	.58	0.82
changeability	1.56	1.50	.57	.61	.72	.84	1.51	1.55	.57	.62	0.76
negative valence	2.86	2.90	.61	.68	.82	.90	2.83	2.92	.62	.68	3.45⊤
ambiguity	3.59	3.65	.80	.75	.80	.89	3.62	3.62	.71	.82	0.02
prob. of reoccurrence	2.76	2.77	.64	.68	.70	.82	2.87	2.66	.60	.74	6.44*
familiarity	2.95	3.05	.61	.62	.82	.90	3.14	2.87	.65	.64	13.35***
duration	2.42	2.36	.59	.63	.85	.92	2.39	2.37	.61	.63	0.29
Emotional reactions 1):						(.85)					
anxious/nervous	2.03	2.04	.54	.56	.64	.78	1.96	2.11	.51	.59	5.84*
depressed	2.21	2.24	.54	.55	.79	.88	2.20	2.26	.55	.57	1.82
aggressive	2.53	2.53	.52	.56	.71	.83	2.47	2.58	.53	.56	2.69
hesitant	2.61	2.68	.49	.58	.69	.82	2.62	2.65	.58	.51	0.34
lethargic	2.66	2.72	.46	.54	.61	.76	2.70	2.68	.49	.52	0.13
abandoned	2.10	2.14	.65	.67	.85	.92	2.08	2.17	.62	.74	1.11
Self-directed coping behavior:						(.87)					
search for information	1.12	1.15	.45	.43	.88	.94	1.18	1.09	.46	.44	4.33*
suppression of informat.	0.69	0.64	.31	.30	.66	.80	0.63	0.69	.30	.33	2.25
re-evaluation	0.69	0.72	.41	.43	.78	.88	0.73	0.68	.46	.40	0.89
palliation	0.89	0.90	.39	.40	.85	.92	0.85	0.94	.42	.43	2.57
self-blaming	0.73	0.73	.33	.36	.67	.80	0.71	0.74	.36	.36	0.12
other-blaming	0.81	0.83	.37	.40	.71	.83	0.82	0.81	.37	.40	0.34
Environment-directed coping behavior:						(.77)					
active influence	1.03	1.13	.32	.34	.60	.75	1.12	1.04	.34	.33	2.50
evasion (escape, avoid)	0.62	0.61	.31	.31	.56	.72	0.57	0.65	.27	.33	9.17**
passivity (wait, resign)	0.93	0.87	.31	.29	.55	.71	0.86	0.94	.34	.28	3.20+
social support	0.49	0.51	.30	.31	.76	.87	0.51	0.49	.31	.33	0.70
Coping efficiency:						(.87)					
problem solving	0.97	1.04	.39	.34	.72	.84	0.97	1.03	.36	.37	1.84
discrepancy ideal/real behav.	1.15	1.13	.45	.44	.81	.90	1.15	1.11	.42	.49	1.70
Representativeness of behavior:	1.96	1.99	.32	.35	.63	.77	1.98	1.97	.34	.35	0.01
Attribution of outcome:						(.81)					
internal	1.59	1.64	.40	.40	.63	.77	1.59	1.63	.38	.46	0.56
external (persons)	1.01	0.97	.37	.41	.69	.81	1.03	0.96	.39	.40	2.74
external (circumstances)	1.07	1.04	.42	.43	.73	.85	1.09	1.03	.42	2.07	
Total						(.85)					

⊤p<.10; * p<.05; ** p<.01; *** p<.001; 1) high values indicate low intensities of emotions

observation. For coping attempts there was an increase in the tendency toward evasion as well as passivity. Yet there was, strikingly enough, also a decrease in the (inner) search for information. With emotional stress reactions there was a tendency towards lower values only for feeling anxious/nervous. The fact that the situations occurring in the second half of the assessment period were judged as being less familiar and as having a lower probability of recurring suggests that subjectively more unusual events were being experienced in the second half of the assessment period, and were faced with somewhat modified coping reactions. Whether the stress was truly different (for example, when some of the students taking their exams actually enter the examination phase) or whether the effect over the course of the assessment period in fact reflects the reactivity of the self-observation (an increasing 'openness' toward unusual stress and the 'confession' of dysfunctional coping methods), cannot be decided with certainty. The low level of reactivity generally, as well as the relatively high reliability found, seems to show that the COMRES system provides useful data for the diagnosis of coping with stress. A difference in reactivity effects dependent on different modes of defense (repression, sensitization; cf. Krohne, 1986) were in any case hardly perceptible (Reicherts & Perrez, 1990).

Social desirability

For the validity of the method it is important to know the extent to which tendencies of social desirability are present in the self-observation and the recording thereof. This is important even when there are no other data sources available (e.g., observation through others) for the event in question. The extent to which the different aspects of the self-described stress process are associated with social desirability are examined. Crowne and Marlowe's (1960) concept and SDS Scale measure (German version of Lück and Timaeus, 1969) were used to this end.

The correlations of the mean values of the self-observation variables showed the following relationships with social desirability. The higher the social desirability, the greater the tendency to perceive situations as less changeable ($r=-.22$; $p<.10$) and the lower the tendency towards feelings of aggressivity ($r=-.30$; $p<.05$) and other-blaming ($r= -.22$; $p<.10$). The correlations to all other COMRES variables are not significant. Thus, there are indeed some plausible relationships between individual aspects of this self-observation method and social desirability. However, their influence overall doesn't seem strong enough to seriously reduce the validity of the diagnostic information gathered using the COMRES method. And when COMRES is used as an instrument for preparing someone for therapy and for accompanying diagnostic measures, clearly one should find that the effects of social desirability are even smaller.

Different variants of the original version and applications

Four different variants of COMRES have been developed until now.

1. The first variant is the above described modality for a *pocket computer,* suited for the study of individual stress experience and coping behavior.
2. The second variant consists of a particular application of the first: For the observation of coping behavior of couples we instructed couples to store 20 to 30 commonly experienced stressful events what we call the *"tandem-application"*. Every couple was asked to store the same commonly experienced episodes. From each episode two protocols had to be completed: The first protocol describes the episode as the subject experienced it (self-observation); the second protocol should inform on the question how the partner behaved in the same situation (hetero-observation) concerning his or her overt behavior. Concerning the partner's inner behavior the observer should store, how he or she thinks that the partner behaved.

For every stress and coping parameter (e.g. appraisal of controllability of the situations,

emotional responses etc.) different parameters can be elaborated by correlation of the four different types of data: The capital letters indicate the person who is observed and the small letter the observer:

Aa   Person A observes herself
Bb   Person B observes herself
Ab   Person A is observed by person B
Ba   Person B is observed by person A.

For the appraisal of the controllability it is, for example, possible to estimate the agreement between Aa and Ab. Discrepancy or correlation scores show how adequate the partners perceive them mutually. This may be an important information on the cognitive base of their interaction: The greater the discrepancy between the stored behavior of A (Aa) and the perception of A's behavior by partner B (Ab), the lower the likelihood of satisfactory interaction. The first results of 5 couple case studies seem to confirm this assumption (Baumann Jmel, 1995).

(3) The third variant focuses more precisely on the *seeking of help or support* as a coping modality. All questions asked to the subject are the same as in the first version, except the item "I sought help from another person". If the subject answers this question affirmatively (scaled answers), the ramified program continues to ask a series of further questions relevant for social network and social support information (Perkonigg, Baumann, Reicherts & Perrez, 1993; Laireiter, Perkonigg, Baumann, Perrez & Reicherts, 1995).

(4) The last version was developed to analyze stress and coping behavior in organizations. We developed a personal computer variant. The BASIC-program was adapted to DOS for the screen of a personal computer. Every subject of the same institution (intensive care units of hospitals) worked with a secret code, which gave access to the program. In each care unit a PC was available for the nursing staff who was instructed to store their stressful episodes as soon as possible after its occurrence (Malacrida, Bomio, Matathia, Suter & Perrez, 1991).

Examples of research results

In this section, a selection of results stemming from different samples and analyses using COMRES methodology is presented: (a) *Descriptive* results concerning domains and themes of stressful episodes (e.g. stressors in social relations, or linked to specific professional domains), including typologies obtained by cluster analysis; (b) results referring to some theoretical expectations or *nomological hypotheses* dealing with emotional reactions and coping behaviors in function of (i) certain situation features or (ii) characteristics of the person as psychological well-being or disorders (e.g. anxiety); (c) results referring to *nomopragmatic* aspects as the short-term effectiveness of coping efforts under certain situation conditions. The underlying theoretical framework is our situation-behavior model of stress and coping (Perrez & Reicherts, 1992).

The results are based on different analyses of COMRES data sets stemming from the following samples: N=60 advanced students (see above); N=20 adults (Perkonigg, Baumann, Reicherts & Perrez, 1993); N=16 nurses (Perrez, Bomio, Malacrida, Matathia & Reicherts, 1992); N=108 nurses (Perrez & Matathia, 1993); N=19 patients (different diagnoses; Fersztand, 1988; Britsch, 1992); N=19 patients with anxiety disorders (Perkonigg & Trübestein, in prep.); N=5 couples (tandem study; Baumann Jmel, 1995).

Examples, themes and types of stressful episodes recorded

Content analysis of a part of the episodes (1457; 61%) of the advanced students' sample (N=60) resulted in the following distribution of stressful events in the sample. The stressful events in the *social area* are dominating (38%), primarily with partner and friends (and less frequently with family or unknown people; 7%). About 22% stemmed from the domain of *academic or working activities* (study, job, or practical work) and 20% referred to *intrapsychic and somatic events* of the subject (13% inner events as cognitions; 7% illness, pain etc.). Further 10% of the episodes were related to *daily life activities*. The remaining episodes covered different domains, such as problems with leisure, apartment, institutions, social or political events.

A few examples illustrate the kind of descriptions made by the subjects.

'My wife comes back home. I haven't prepared supper yet. She is angry.'

'I am startled by a German shepherd suddenly appearing as I am walking my dog.'

'I become upset because tomorrow I have an exam. Maybe I'm not well prepared and I feel shaky.'

Types of recorded situations

The COMRES-method elicits different features of the situations as perceived by the subject; their controllability, changeability, valence, ambiguity, subjective probability of reoccurrence, the duration of the stressor, and the subject's familiarity with the situation. The question is whether this method can identify types of situations by an inductive multidimensional procedure.

To answer the above question the total number of 2381 episodes stored was submitted to a cluster analysis. The formation of clusters was based on the weighted average distances method (Euclidean distances) with stepwise formation of centroids, and given maximum number of clusters (SPSSX method Quick Cluster), which was fixed according to the number of situation variables included.

The cluster analysis reveals three major types of situations which cover 66% of all episodes of the pool.

Type 1 situations: The greatest cluster (741 situations) is characterized by the following cluster means:
fairly high controllability (3.2),
low changeability (0.9),
fairly high negative valence (3.4),
high transparency (4.3), i.e., low ambiguity,
relatively short duration (half an hour/one hour; 2.3),
fairly high familiarity (3.4).

This type of situation concerns everyday matters – which are important nonetheless – and which are perceived as fairly controllable. The stressor is relatively unambiguous and of short duration. Example (1) above, for instance, belongs to this cluster. It can be assumed that this kind of situation with high 'net' control (i.e., controllability exceeding by far changeability - 2.3 scale points) facilitates active coping and reduces the probability of re-evaluation.

Type 2 situations: The second cluster holds 454 episodes. They are described by the following configuration of features (cluster means):
fairly low controllability (2.2),
low changeability (1.4)
high negative valence (3.8),
low transparency (2.3),
longer duration (several hours, 4.3)
and high familiarity (4.6).

The low 'net control' (0.8), and the low 'overall probability' of a positive outcome, combined with high valence and longer duration can be interpreted as the kind of stressful situation which tends to elicit depressive and helpless feelings and passive and evasive coping responses. Example (2) belongs – except for its shorter duration – to this type.

Type 3 situations: The third cluster (382 episodes) is characterized as follows (cluster means):
fairly high controllability (3.2)
fairly changeability (2.8)

fairly low negative valence (2.4)
fairly high transparency (3.8),
medium duration (2.9), and
high familiarity (4.4).

The centroids of the third cluster reveal a situation type of low 'net control' (controllability only slightly exceeds changeability: 0.3), and fairly low valence and ambiguity. Nevertheless, controllability and changeability are not as low as in type 2 situations. Example (3) belongs to this situation type (except for its low negative valence). Therefore it should elicit some active influence, combined with passivity (waiting) and evaluation-oriented coping responses.

These three main clusters of stressful episodes, emerging from an inductive cluster analysis method, seem to represent different patterns of stressful situations. They are multi-dimensional prototypes of situations which are compatible with the theoretical assumptions.

The emotional and coping *responses observed* in these three clusters can be predicted with regard to the situation characteristics given: Actively influencing on stressor is most apparent in cluster 1, and least apparent in cluster 2. Evasive and passive (waiting or resignation) behaviors are most apparent in cluster 2, and lowest apparent in cluster 1. Palliation is increased in cluster 2, whereas re-evaluation dominates in cluster 3. Stressful emotions of being depressed, nervous, and abandoned are increased in situations of type 2.

Structuration of stressful episodes: chaining and connecting

The COMRES allows the subject to connect his episodes in function of sequences (evolution of episodes) or thematic relations between them. Hence it is possible to analyze the *perceived structuration* of micro-episodes. 'Repressors' and 'sensitizers' (operationalised as a two-dimensional trait combining the subjects' anxiety scores with his social desirability scores; e.g. Krohne, 1986) showed the expected difference (Reicherts & Perrez, 1990): Sensitizes recorded more connections or chainings between episodes (40%) than repressors (30.8%), especially 'transitory' episodes (11% vs. 6.5%) indicating a high degree of perceived relatedness of the episodes. A difference was also found for subjects high in BDI depression scores which recorded less connections (only 23.4%) compared to low depression subjects (31.3%) (Reicherts, 1988). There was no difference between the total amount of episodes recorded (in accordance with instructions).

Episode chaining indicates the subjects' perception of relations between micro-episodes which can reflect stressful themes (e.g. recurrent or chronic stressors) as well as macro-stressors and their evolution (e.g. critical life events) who are predominant in the subjects' everyday stream of experience.

Stress and coping by couples

First results of the *tandem variant* of COMRES (Baumann Jmel, 1995) may answer the question: do stressful episodes shared by the partners (recording based on specific episodes) differ from the episodes of the students' COMRES results (recording based on personal episodes in general).

Other than the episodes of the individual application which covers all events, domains, even intrapsychic, the shared episodes concentrate on leisure, household (budget, activities), working (professional), disagreements and arguments. Concerning the situation characteristics, the common episodes are less controllable, more changeable and (somewhat) less stressful, and less probable to reoccur than the episodes of the students' data.

Patterns of emotional reactions accentuate more aggressive and more activated (energetic, spontaneous) feeling states (according to the pattern of 'anger' the partners experience more

'activated anger' than the subjects of the other COMRES studies).

Their coping behavior shows less search for information, less palliation and self reproaches, but considerable more reproaches to the other. Environment-directed coping efforts accentuate less active influence and less social support.

Concerning the situation characteristics of the common episodes as *evaluated by both* partners (A-B), there is considerable accord between their appraisals (duration, familiarity, probability of reoccurence etc.). There is also some accord between their emotional reactions (as feeling nervous, depressed or aggressive, which are more "visible" or "shown" than others) and their coping reactions. The accord between the behavior of one partner (A or B) and his behavior as evaluated by the other (Ab or Ba) is an indicator of the quality of *reciprocal perception* in shared stressful episodes. This accord (A-Ab and B-Ba) varies in function of the reaction etc.. Disaccord can indicate problems of interaction and even of the relationship.

External criteria as Marital Satisfaction (MNS-Scale, Stinnet, Collins & Montgomery, 1970), or mental (SDSG-scale, Becker, 1984b) and physical health (PSSO) show some relations to the stress and coping data on the individual level as well as on the reciprocal level.

Professional stress in the hospital

Two studies were made in the domain of medical care units (Perrez, Bomio, Malacrida, Matathia & Reicherts, 1992; and Perrez & Matathia, 1993). Their results helped to understand the stress occurring in a specific professional domain: the stress of nurses in intensive care units and urgent care units.

Results of the first study (N=16) reveal that the episodes most frequently recorded by the PC-version of COMRES (see above) are "confrontation to dead and dying" (33%), "work load" (32%) and "conflict" with physicians or other nurses (17%). The sources of stress were attributed to patients and their families (39%), administration (36%), and interpersonal relationships with other nurses or physicians (17%).

Problems inherent to the tasks of the medical care system could be separated from problems the system has with itself. The first type of problem is more or less natural, resulting from the purpose of medical care. However, problems with administration, with others nurses or with physicians are problems of the system itself which hinder the institution in its original function.

Using cluster analysis of the situation characteristics, it was possible to find two types of situations: situations with a longer temporal extension, with low changeability and low controllability, with a high negative valence and probability of reocurrence (type 1; 37%), and situations of a shorter duration which are more controllable, more changeable and less straining (type 2; 63%). As predicted, The first 'depression-inducing' type of situations engendered more intense emotional reactions, less active coping efforts, more re-evaluation, palliation and other-blaming. Attributions of episode outcome were more external (caused by other persons or circumstances).

Stress and coping in daily life and psychological well-being (external indicators)

Stress and coping reaction tendencies of the subjects recorded by the COMRES showed a lot of substantial and plausible correlations with indicators of mental health and psychological well-being (Perrez, 1992): depression, anxiety, well-being, positive perspectives in life. The higher subjects score on the BDI (Beck, Ward, Mendelson, Mock & Erbaugh, 1961) the more the recorded everyday situations are judged as stressful (negative valence) and the more probable they expect the recurrence of the stressor to be. Depression scores were also correlated with negative emotional reactions (feeling depressed, aggressive, abandoned), self-directed (self blaming or information suppression) and environment-directed coping behaviors (evasion and passivity). The higher the subjects' depression scores the more they perceived discrepancies between their real and ideal coping behavior

and the less they evaluated the outcome of the episodes as successful.

In general this is a parsimonious picture of depression and coping based on a new set of data resulting not from a retrospective point of view, or from questionnaires on hypothetical situations, but from structured descriptions of real life episodes, with only short latency times between their beginning and being recorded.

There was a similar pattern of correlations for anxiety (STAI trait and state; Laux, Glanzmann, Schaffner & Spielberger, 1981) and psychological well-being (SDSG-scale). About half of the variables recorded by COMRES showed expected (or plausible) correlations with stress and coping tendencies recorded during daily life stressful episodes.

The fact that mental health is operationalized in part through indicators of emotionality does not trivialize the connections to the COMRES variables; these are not based solely on emotional status, but also on cognitive and coping actions. They don't refer primarily to global traits bur concern real life situations. In this sense COMRES has proved effective as a field method of data collection. COMRES allows researchers to gain insight into specific coping styles in different states of mind (e.g. depression). In the future it may be possible to monitor changes in coping styles as patients undergo psychological therapy. It would then be possible to explore if mood changes before cognition coping or vice versa.

Results of COMRES in the clinical setting

Recently, COMRES was applied in the clinical setting in order to analyze daily stressful events of patients (n=19) suffering from anxiety disorders (Perkonigg & Trübestein, in prep.). Compared to the non-clinical groups, the anxious out-patients described stressful events of lower controllability and higher probability of reoccurence. Their coping efforts focused more on information suppression and palliation, and their coping was less successful in resolving the problem. The level of anxiety experienced in everyday stressful situations was correlated with evasive, escaping or avoiding behavior. Episodes of stress and anxiety compared with non-stressful (time-based) recordings were more frequent when patients were on the way, with strange people, used public transports or were in institutions or official buildings.

Other results

Further results allowed the analysis of the role of *social support*. In the study of Perkonigg et al. (1993), in about 44% of the 567 everyday stressful episodes the subjects laid claim to the help of others, implying primarily colleagues (20%), partner (17%) and relatives (14%). Functions of support (emotional discharge, information, practical help, etc.) varied with the characteristic of the situation. In the study of Reicherts (1993), in 35% of the 2527 stressful situations the subjects requested the help of others. As expected, the situations were characterized by higher negative valence, less familiarity and longer duration than episodes without social support, but not less controllable. Social support had a positive influence on coping effectiveness (problem solving), even when situation characteristics were partialled out. An interaction effect indicated that social support had greater influence on problem solving when the subjects' (own) activity was low.

Other studies on *anger* in everyday stressful situations (Reicherts, 1993), and on specific types of appraisal responses (Reicherts & Perrez, 1989; Perrez, 1994) revealed specific emotional patterns and coping tendencies as a function of the cognitive appraisal processes which are in line with prediction of appraisal theories of emotion (e.g. Scherer, 1993).

Assessing adequate coping: the behavior rules approach

We proposed to conceptualize coping behavior as 'adequate' or 'appropriate' if it corresponds to several criteria of rationality, including effectiveness and the cost-benefit relationship (Reicherts & Perrez, 1992; Reicherts, 1996). As

criteria we suggest that the person's coping with stress in a given situation corresponds to a behavior rule, that (1) recommends this type of behavior in such a situation, because it is proved to be *effective* under the given internal and external *situation characteristics*. (2) The costs and negative side effects have to be countered acceptably by the benefits (*efficiency*). (3) The behavioral means to achieve stress reduction must be ethically acceptable.

We formulated several behavior rules for adequate coping referring to a limited number of situation features (Reicherts, 1988; Reicherts, 1996). These *rules of adequate coping (RAC)* are situated on a strategic level and recommend instrumental coping behaviors as stressor-related active influence or evasive behavior, and self-directed coping behaviors as information seeking and reevaluation or palliation. Recommendations apply to given situation characteristics as controllability, changeability, negative valence or probability of reoccurence; they also respect basic cost-benefit criteria.

Behavior rules can be *founded* like other 'technological rules' (Bunge, 1967; Perrez & Patry, 1982) by proving their effectiveness in empirical studies. With this aim, the situation-behavior patterns of the COMRES episodes of the original N=60 students' sample were analyzed in terms of their *conformity to* the recommendations of the different RAC (conformity varied between 50% and 70%). Conformity was then compared to the outcome of the episodes (problem solving, perceived behavior discrepancies). The results show for example, that active influence in situations of high controllability and low changeability resulted more frequently in problem solving, as well as re-evaluating in probably recurrent situations, than did situation-behavior patterns not according to the rules. Rule conforming coping behavior was also followed by less real-ideal behavior discrepancies perceived by the subject. The COMRES results support the rules of adequate coping in terms of these short-term´ effects (Reicherts, 1996; Perrez & Matathia, 1993).

Clinical data. The COMRES data of N=19 patients suffering from different psychological disorders (anxiety, depression, bulimia nervosa, alcohol abuse etc.) also revealed better coping effects if the patients' behavior conformed to the coping rules. However the patients *conform less frequently* to the BR (especially concerning evasion, reevaluation and palliation); therefore they experience less overall coping success. Unresolved stressful situations have negative influence on psychological and physical well-being: distortion of hemeostasis lasts longer and makes the subject more vulnerable to the next potential stressor. This crucial hypothesis receives (first) empirical evidence by the analysis of daily stressful episodes gathered by the COMRES methodology: Psychological stress of patients is augmented (e.g. the overall negative valence) because their coping strategies are inadequate – if they are lacking the behavioral competencies (e.g. re-evaluation or palliation techniques) or selecting the wrong behavior with regard to the situation's characteristics.

As this analysis focuses on situations features *as perceived* by the people involved, appropriateness of coping (coping rule conformity) is assessed in terms of *internal adaptation*. Since external adaptation implies objective criteria, the subjects' coping behavior should also assessed in terms of "*realism*", i.e., the adequate representation (appraisal) of objective situation characteristics. *Realism* is a further criterion of appropriate coping behavior which cannot be evaluated with the original data structure of COMRES.

The COMRES method allows assessing the subjects' stress and coping behavior according to the intersubjectively (objectively) founded rules or strategies. Assessment can be based on the *criterion-oriented testing* approach (e.g. Ebel, 1962; Klauer, 1987), comparing the subjects coping pattern with a standard of "competence" (mastery). With regard to a given standard of mastery (e.g. 70% of episodes conforming to the RAC), there are fewer patients qualified as "competent" than there are subjects of the non-clinical samples (Reicherts, 1996).

User's acceptance of COMRES and problems

Our first study has shown that COMRES is a practical and useful method for the event-oriented self-observation of stress and coping. It is easy to carry and data was often directly recorded. The average time necessary for an episode was about 5 minutes. At post-interview, 80% of the subjects reported a tendency towards increased self-reflection during the experiment, and 50% noted small changes in their own behavior and experience during the assessment. This – in addition to other insights gained during the post-interview – indicates the generally positive acceptance of the method. Yet some of the subjects did not view the assessment completely positively. Whereas in the individual assessments they judged their own coping behavior and experience for the most part as being 'typical', they later reduced their judgment of the representativeness of the described events by half. This is apparently due to the fact that individual, subjectively important events also took place which some subjects did not 'reveal' to their computer. Thus, in the light of these reserved events, some subjects' event samples were incomplete.

Problems arising during data collection seem to be correlated with the motivation of the individual subject(s). This view is confirmed from initial use of the method in clinical settings, e.g. with alcoholics and women suffering from bulimia; the degree of suffering and therapeutic motivation increases the conscientiousness with which recording with COMRES is done. Again, the face validity of the self-observation categories employed seems to further the acceptance of the method among users. Difficulties in the use of computer techniques declined even among non-students after proper training of the subjects is completed.

Summary and outlook

In summary, the main characteristics of the COMRES method give some hope for its usefulness regarding most of the self-observation variables. The situation prototypes emerging from event sampling are plausible, reliability is satisfactory, reactivity effects over time are minimal and the effects of social desirability are limited. Self-observation in everyday stress situations over a period of several weeks and the subsequent summation of subjective mean values is thus not only methodologically possible, it is indeed quite effective. The approach (trained self-observation of everyday stress) and the method used (multi-dimensional assessment with pocket computer) resulted in satisfactory findings, at least for the different populations studied.

In addition to measuring stress and coping, the method opens up new approaches to the study of the psychology of everyday life as well as to assessment and to diagnostic procedures under naturalistic conditions in the clinical context (Perrez, 1994). Many of the methodological problems related to questionnaires and interviews are not associated with this new access to subjective data: the time lag between stressful event and its recording can be minimized; the chaining of episodes over time can be easily represented (much more readily than the usual diary method); the computer-aided self-observation system can adapt the selection of questions to specific features of situations or peculiarities of the scientific problem. The interviewer/ee bias is eliminated.

Initial analysis of the relationships between characteristics of coping with stress and various indicators of mental health reveal, on the group level, relevant correlations with a number of indicators as well as with Beck's Depression Inventory and the State-Trait-Anxiety Inventory.

On the individual level the relationships between situation characteristics as perceived by the subject and the subject's attempts at coping was particularly interesting. Such rules

(strategies) and regularities in coping behavior can be studied using the contingency-based method of behavior rule conformity analysis. This could lead to personal stress and coping scores including criterion-oriented measurement in the field, possibly even leading to situation-specific recommendations about how to cope with stress.

The development of this method carries with it the hope that it may be possible to expand even further this new methodology of self-observation in the field. Thus, it could become useful for theory-guided recording and direct analysis of stress and coping behavior. In addition, by simplifying the structure of the questions and the overall operation of the system, by improving the safety of use, and by implementing analysis programs directly in the COMRES computer, it is possible to develop the idea of a *'external memory against stress'* especially if the method is employed in a clinical and health care surrounding.

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