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Stressor–burnout relationship in software development teams

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Burnout is an experience relevant not only to psychosocial professions, but also to technical work. It is predicted that in a technical profession work stressors are related to burnout and that this relationship is moderated by control at work, task requirements, and the quality of team interaction. In a sample of 180 software professionals from 29 software development projects, stressors were found to be positively related to burnout measures. Control at work, complexity at work, and openness to criticism within the team were all found to be significantly negatively related to lack of identification. Moderated regression analyses revealed that high cognitive requirements, high learning requirements, and low competition within the team enhanced the relationship between stressors and burnout.

There is little existing research pertaining to long-term effects of working conditions in technical professions such as software development or other fields of research and development (Curtis, Krasner & Iscoe, 1988; Goldstein & Rockert, 1984; Keenan & Newton, 1987). Long-term effects can exist both in performance and strain areas. One issue linking these two areas is the burnout phenomenon. It is important to examine whether or not burnout occurs in technical professions, and if so, under what conditions, because the consequences of burnout may have an impact on the long-range adjustment of people within a company and on the teams in which they work.

The concept of burnout

The term burnout is usually applied to strain symptoms in psychosocial professions. Across various definitions, burnout is described as an individual's negative emotional experience leading to a chronic process (Maslach, 1982*b*; Shirom, 1989). It is experienced as exhaustion on a physical, emotional and cognitive level (Pines, Aronson & Kafry, 1981; Shirom, 1989). Most definitions include withdrawal and decreasing involvement in the job, especially by persons who have been highly involved in their work.

If one uses a broad concept of burnout including physical fatigue and cognitive weariness (Shirom, 1989), it becomes evident that burnout symptoms also occur in technical professions. There are studies showing burnout to exist outside the field of psychosocial

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work, for example in engineers (Etzion, 1988) or secretaries (Nagy, 1985). These findings suggest that there are factors other than those inherent in a psychosocial job which may lead to burnout, such as the discrepancy between one's expectations concerning the work and one's experiences (Lauderdale, 1982), or stressors in the work situation (Carroll & White, 1982; Maslach, 1982*a*; Perlman & Hartman, 1982; Pines *et al.*, 1981). In relation to this Jackson, Schwab & Schuler (1986) have indicated that burnout is associated with involving and demanding work.

Work characteristics in software development projects

The possibility that burnout also occurs in software development is suggested by studies such as that of Kumashiro, Kamada & Miyake (1989), which showed the stress scores of software engineers to be higher than those of other professionals. Factors in the work situation contributing to the overall high stress scores were pace of work and overtime. Fujigaki (1990) reported that especially during requirement analysis and debugging, i.e. under conditions of time pressure, strain level rose. In another study (Ivancevich, Napier & Wetherbe, 1983, 1985), problems in communication, time pressure and overload were identified as typical stressors among software professionals. In addition, work in software development is characterized by high intellectual demands (Glass, Vessey & Conger, 1992). It is very involving and requires permanent acquisition of knowledge and learning (Brodbeck, Sonnentag, Heinbokel, Stolte & Frese, 1993; Walz, Elam & Curtis, 1993). Rubin & Hernandes (1988) reported high intrinsic work motivation in software professionals, which may make them prone to the development of burnout if they work in a stressful environment (Pines & Aronson, 1988).

Stressors, other work characteristics and burnout

When analysing work situations three different work characteristics can be distinguished: regulation problems (i.e. stressors), control at work and work requirements (Frese & Zapf, 1994). When work tasks are performed in teams—as is the case in software development—social interaction in the work-group is also an important feature of the work situation. It is expected that these various work characteristics are related to the experience of burnout.

We assume that burnout among software professionals is associated with the experience of stressors in their work situation. This relationship has been found to be true for various other professional groups, such as workers in human services (Shinn, Rosario, Morch & Chestnut, 1984), teachers (Russell, Altmaier & Velzen, 1987), or library media specialists (Fimian, Benedict & Johnson, 1989). Weiss (1983) studied a sample of information system managers and reported relationships between job stress and psychological strain measures that were similar to those found in other professions. Thus, it can be hypothesized that work stress in software development projects is positively correlated with burnout.

Until now, the relationship of control at work and high work requirements to burnout has not been studied very extensively. However, existing studies have shown that control at work, job challenge, and tasks with a high motivation potential are negatively correlated with burnout (Friesen & Sarros, 1989; Gaines & Jermier, 1983; Landsbergis, 1988).

Therefore, we hypothesize also that in software professionals control at work and high work requirements are negatively related to burnout.

The quality of team work is influenced by social interaction in the group. To the best of our knowledge, such interactions have not yet been studied in relation to burnout. The nearest empirical work deals with social support, showing negative relationships between supervisor and co-worker support and burnout (Etzion, 1984; Himle, Jayaratne & Thyness, 1989; Russell *et al.*, 1987). Gaines & Jermier (1983) reported employees' emotional exhaustion in high stress organizations to be negatively correlated with work-group cohesiveness. Additionally, informal contacts with colleagues showed a negative relationship with emotional exhaustion and lack of personal accomplishment (Leiter, 1988). It can be assumed that in teams with a favourable social interaction, social support can be more easily provided. This leads to the hypothesis that a high quality social interaction within a team will be negatively related to team members' burnout.

Moderator effects on the stressor–burnout relationship

It can be assumed that the relationship between the previously discussed work characteristics and burnout is not exclusively direct. It is expected that control at work, work requirements, and quality of team interaction also have moderating effects on the stressor–burnout relationship.

The relationship between stressors and burnout in software professionals might be influenced by control at work because control enhances the opportunity of coping with a stressful situation (Frese, 1989) and also provides the possibility of leaving stressful situations. In studies of both blue-collar workers and psychosocial professionals, moderating effects of control on the relationship between stressors and psychosomatic complaints were found (Frese & Semmer, 1991; Maslach, 1982*a*). Therefore, it is expected that control at work will reduce the relationship between work stress and burnout for software professionals as well. On the other hand, high requirements such as complexity at work do not offer chances to cope with stressors but put additional demands upon the individual (Frese, 1987). Therefore, we hypothesize that high requirements will increase the relationship between stressors and burnout.

Finally, we assume that high quality social interaction within a team mitigates the negative effects of stressors on burnout, in a way similar to the effect of social support (Etzion, 1984; Frese & Semmer, 1991; House, 1981; LaRocco, House & French, 1980; Pines *et al.*, 1981).

Summary of hypotheses

The hypotheses can be summarized as follows:

1. Work stress is positively correlated with burnout.
2. Control at work, high requirements and a high quality of social interaction are negatively correlated with burnout.
3. Control at work reduces the relationship between stressors and burnout.
4. High requirements increase the relationship between stressors and burnout.
5. High quality social interaction within a team reduces the relationship between stressors and burnout.

Method

Sample

The study was carried out at 29 software development projects from 19 German and Swiss companies. The projects studied produced software covering a broad application domain, including the administration of small and large companies, telephone and communication purposes, banks, insurance companies, traffic institutions, and process control software. Thirty-four per cent of the projects were studied during the early phases of software development (i.e. requirement analysis and software design), 28 per cent during coding and testing (including integration testing), and 38 per cent during delivery and maintenance. The mean project size was 10 members (SD = 4.8); an average of 74 per cent of the members in a given project participated in the study (SD = 26.3).

The total sample size was 200 persons. With 186 subjects a three-hour structured interview was held. One hundred and eighty persons filled in a questionnaire. Because the questionnaires were filled in and returned after the interviews the return rate led to missing data. Full data were available for 166 persons. Of the subjects, 62.1 per cent were systems analysts and programmers, 14.8 per cent team leaders, 10.8 per cent subteam leaders, 9.9 per cent user representatives, and 2.5 per cent had other, mostly administrative tasks in the project. The subjects had spent an average of 5.7 years in software development projects. Most of them were male (75 per cent). The average age was 33 years.

Measures

All scales were in German. Means, standard deviations, reliabilities and intercorrelations for the scales are shown in Table 1.

Burnout. There was no existing burnout scale which was well adapted for use with software developers. Therefore, a new 16-item measure was created, based on the Maslach Burnout Inventory (MBI; Maslach & Jackson, 1986). In order to investigate the structure of this questionnaire a principal component analysis was performed. Since factor solutions break down easily in replications, the total sample was randomly divided into two subsamples. For each subsample a separate principal component analysis was computed. At first, the result was a stable three-factor solution for both subsamples[1]. The first factor was interpreted 'lack of identification', and is similar to low 'personal accomplishment' as described by Maslach & Jackson (1984). The second factor included aspects of pressure and exhaustion, and the third factor, pressure and loss of a sense of quality.

For reliability reasons the second and third factors were combined. Again, a principal component analysis was performed, now forcing a two-factor solution on the data. The result was a stable two-factor solution in both subsamples (see Table 2). The first factor explained 28.6 per cent of the variance in the first subsample (31.4 per cent in the second subsample), and the second factor explained 15.1 per cent (15.6 per cent) of the variance. The new second factor was called 'perceived pressure'. Cronbach's alphas were .86 for the first and .62 for the second factor.

The intercorrelation between the two burnout factors is rather low (.10). Other studies have reported similar intercorrelations between lack of personal accomplishment and emotional exhaustion (Leiter, 1988; Maslach & Jackson, 1981). Since lack of identification corresponds to low personal accomplishment, and perceived pressure to emotional exhaustion, it is obvious that our findings are in accordance with the already existing research on burnout.

Stressors. Stressors in the work situation were ascertained with a 20-item questionnaire (Frese, 1988). The scale covers various sources of stressors: stressors in the work itself such as quantitative overload (e.g. 'I have too

[1]For the first subsample, the first analysis generated a four-factor solution, explaining together 56.9 per cent of the variance. However, the fourth factor consisted only of one item ('Someone who doesn't put his heart into a job like mine should switch to another profession'). Since this item reflects more an attitude than a burnout symptom, the item was excluded from further analysis. With the 15 remaining items a PCA was performed for the second subsample, forcing a three-factors solution on the data. The factor solution is consistent with that found in the first subsample, with all items showing factor loadings higher than .50. The three factors together explain 56.6 per cent of the variance. Tables for the two subsamples with factor loadings can be obtained on request from the first author.

Table 1. Means, standard deviations, reliabilities and intercorrelations for all variables

Variable	*M*	SD	1	2	3	4	5	6	7	8	9	10	11	12
Burnout														
1. Lack of identification[a]	2.3	0.6	(.86)											
2. Perceived pressure[a]	2.6	0.5	.10	(.62)										
Work situation														
3. Stressors[a]	2.3	0.5	**.29**	**.64**	(.88)									
4. Control at work[a]	3.8	0.6	**−.44**	.07	.05	(.83)								
5. Complexity of work[a]	3.4	0.6	**−.51**	.14	.02	**.43**	(.61)							
6. Cognitive requirements[b]	49.1	21.0	**−.24**	**−.22**	**−.32**	.12	.21	(–)						
7. Learning requirements[b]	23.5	17.9	**−.18**	.08	**−.14**	**−.01**	.13	**.29**	(–)					
8. Communication requirements[b]	44.7	26.3	**−.24**	.11	.03	**.35**	**.30**	.14	**.21**	(–)				
Group interaction—Aggregated measures[c]														
9. Democracy[a]	3.8	0.4	**−.20**	**−.20**	**−.30**	.12	**.21**	.17	.04	**.23**	(.79)			
10. Openness to criticism[a]	3.7	0.3	**−.24**	**−.13**	**−.20**	.07	**.29**	.17	.12	.15	**.78**	(.80)		
11. Competition[a]	2.2	0.4	.10	.08	**.19**	.01	**−.15**	**−.12**	**−.04**	**−.01**	**−.64**	**−.79**	(.74)	
12. Dominance[a]	2.7	0.5	.11	.08	**.19**	**−.08**	**−.16**	**−.20**	**−.11**	**−.20**	**−.72**	**−.83**	**.88**	(.77)

Note. Values in parentheses are reliability coefficients (Cronbach's alpha). *N* varies from 106 to 180 depending on missing values. Coefficients statistically significant at $p < .01$ are in bold.

[a]Variables scored such that 1 means very low and 5 means very high.

[b]Per cent of working time.

[c]Reliability coefficients based on individual data.

Table 2. Items, factor loadings and communalities of the burnout scale—Two-factors solution

	Subsample 1			Subsample 2		
	Factor 1	Factor 2	Communality	Factor 1	Factor 2	Communality
8 I can realize my professional ideals in my job	*.76*	−.19	.60	*.81*	−.07	.66
16 I can identify myself with my tasks	*.74*	.16	.58	*.73*	.17	.56
14 My work impedes my creativity (and expects too little from me)	*−.73*	−.00	.53	*−.74*	−.10	.55
5 In my profession I can use my abilities completely	*.71*	−.25	.58	*.81*	.01	.66
12 At work I can bring in many of my own ideas	*.65*	.24	.48	*.68*	−.06	.46
7 Today I would choose the same profession again	*.64*	−.20	.45	*.76*	−.03	.58
4 I like to stay at my work place	*.58*	−.03	.34	*.60*	−.08	.36
15 I miss feedback about my performance	*−.50*	.40	.41	*−.60*	.17	.38
3 Sometimes I think about giving up my job	*−.49*	.45	.45	*−.67*	.10	.46
9 I often have to make cutbacks concerning my quality standards because time pressure is too great	.14	*.60*	.38	.09	*.70*	.50
13 In my job I always have to run at top speed because one difficult task follows another	.49	*.60*	.60	.19	.69	.51
1 My profession is a profession in which one is constantly overcharged	.08	*.57*	.33	−.13	*.75*	.57
6 I feel used up at the end of the workday	−.16	*.55*	.33	−.06	*.55*	.30
10 I have a job about which nobody can decide if it was performed well or badly	−.17	*.55*	.33	−.20	*.36*	.17
2 All of these guidelines and regulations hinder me from perfect task accomplishment	−.20	*.36*	.17	−.02	*.57*	.32

much work'), stressors concerning performance and responsibility (e.g. 'I take too much responsibility for other people'), stressors concerning lack of influence (e.g. 'I am held accountable for things that I cannot influence'), stressors because of lack of career prospects (e.g. 'I have no opportunities for learning, increasing qualification, or development'), and stressors resulting from organizational policy (e.g 'Information comes too late or is too vague').

The validity of this stressor scale was examined by relating the stressor scores to an objective indicator of quantitative overload and time pressure. Therefore, from six to 12 months after the first investigation project, leaders and managers of 22 teams were asked if the intended schedule for intermediate products, milestones, and the final product had been kept (five-point Likert item). The project leaders' and managers' assessments of project delay was correlated .47 ($p < .05$) with the mean stressor scores in that project. In addition, the individual level correlation between the stressor scale and hours of overtime—considered a more objective measure—was .26 ($p < .01$). Although these correlations are not very high, they still indicate that perceived stressors correspond to objective indicators of a stressful situation. However, one would not expect higher correlations since the stressor scale also includes stressors other than quantitative overload, time pressure, and overtime.

Other work characteristics. Other work characteristics consisted of five variables: control at work, complexity of work and cognitive, learning and communication requirements. Control at work and complexity of work were ascertained by two questionnaire scales developed by Semmer (1984) and adapted to clerical work by Zapf (1991). Control at work consists of six items (e.g. 'Can you decide *how* you do your work?'). Complexity of work is a scale with four items (e.g. 'Do you get special tasks that are unusual and exceptionally difficult?'). Semmer & Dunckel (1991) reported correlations of .50 and .54 for control at work and complexity of work with observational data in a sample of factory workers.

The cognitive, learning and communication requirements were assessed in an interview. The subjects were asked to give percentages of time spent for thinking (in contrast to performing routine tasks), for the acquisition of new knowledge, and for communicating, coordinating or cooperating. These three percentages are not distinct categories, of course, since it is possible to do two or more things at the same time, for example to acquire knowledge while communicating.

Quality of team interaction. The quality of social interaction in the team was measured with four scales based on items by Watson & Michaelson (1988): democracy (six items; e.g. 'We encourage reticent members'), openness to criticism (six items; e.g. 'We take criticism as a valuable contribution to our individual work'), competition (five items; e.g. 'There are open hostilities among team members') and dominance (five items; e.g. 'Several team members tend to dominate discussions'). For the analyses, aggregated team measures were used based on the mean of the individual perceptions within each team. These measures reflected the average perceptions within the teams and can therefore be seen as more 'objective' measures (Frese & Zapf, 1988).

Since the use of aggregated scores is only justified if there is a certain amount of perceptual agreement within the teams (James, 1982), inter-rater reliability was computed using a procedure proposed by James, Demaree & Wolf (1984). For democracy the inter-rater reliability ranged from .86 to .98 (median = .94), for openness to criticism from .75 to .98 (median = .93), for competition from .76 to .99 (median = .95), and for dominance from .57 to .95 (median = .87). This indicates a high amount of agreement within the teams, thus justifying the use of aggregated scores.

Data analysis

The data were analysed by using separate moderated regression analysis for the two criterion variables, lack of identification and perceived pressure (Stone & Hollenbeck, 1984; Zedeck, 1971). In the first step all main effects, i.e. stressors, control at work, complexity at work, cognitive, learning and communication requirements, and quality of team interaction measures, were entered into the equation. In the second step all interaction effects were entered into the equation. These interaction effects were computed as the product of stressors × control at work, stressors × complexity at work, stressors × requirements, stressors × team interaction measures. A significant increment of R^2 in this second step indicates the existence of moderator effects. Because the moderated regression approach is a conservative procedure (Clegg & Wall, 1990), the significance level was fixed at .10 instead of .05 (as was, for example, done by LaRocco *et al.*, 1980).

Results and discussion

The results of the regression analyses are presented in Tables 3 and 4. The tables show the multiple correlations, squared multiple correlations, the increment of R^2 when entering the interaction terms into the equation, corresponding F values, partial correlations between predictors and burnout scores when controlling for all other predictors in the equation, regression coefficients, and the corresponding t values. It can be seen from Table 3 that stressors, other work characteristics, and quality of team interaction accounted for 43 per cent of the variance in lack of identification, with stressors, control at work, complexity of work, and openness to criticism showing significant regression coefficients. This means that with respect to the burnout factor lack of identification, hypothesis 1 was supported by the data, and hypothesis 2 was partly supported.

When entering the interaction terms into the regression equation, an additional 7 per cent of the variance in lack of identification was explained. The significant positive interaction effect of stressors × cognitive requirements indicates that high cognitive requirements increased the relationship between stressors and lack of identification. This interaction effect is shown graphically in Fig. 1. Software professionals reporting high cognitive requirements revealed higher burnout scores if the level of stressors was high and lower burnout scores if the level of stressors was low than was the case for those with low cognitive requirements.

At first glance this result seems to contradict the negative zero-order correlation between cognitive requirements and lack of identification. However, in general, cognitive requirements are challenging and can, therefore, be conceptualized as a positive factor.

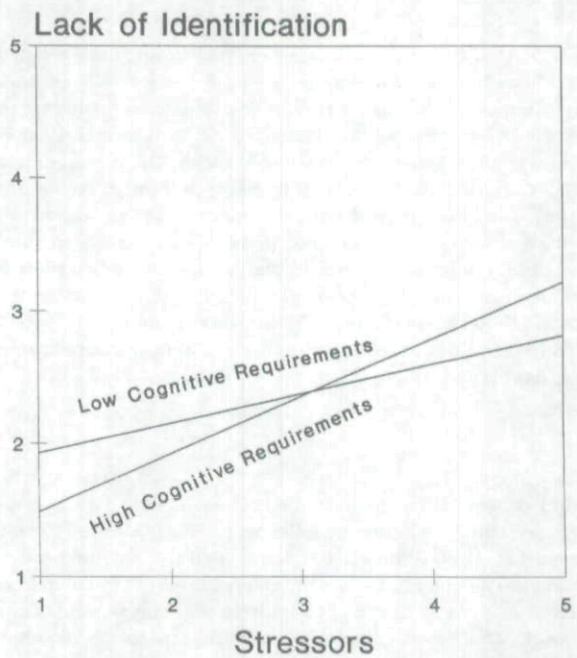

Figure 1. Moderator effect of cognitive requirements on the relationship between stressors and lack of identification.

Table 3. Multiple regression of lack of identification on stressors, other work characteristics and quality of team interaction

Predictor	R	R^2	F	R^2_{inc}	F_{inc}	Partial corr.	B	t_B
Step 1	.653	.427	8.866**	.427	8.866**			
Stressors						.36	.3446	4.262**
Control at work						−.25	−.2030	−2.775**
Complexity of work						−.31	−.2876	−3.611**
Cognitive requirements						−.03	−.0005	−0.305
Learning requirements						−.06	−.0014	−0.602
Communication requirements						−.09	−.0018	−1.014
Democracy						.07	.1378	0.758
Openness to criticism						−.19	−.5630	−2.114*
Competition						.00	.0104	0.045
Dominance						−.09	−.1971	−0.938
Step 2	.709	.450	5.780**	.073	1.775[a]			
Stressors × control at work						−.05	−.0988	−0.525
Stressors × complexity of work						−.11	−.1857	−1.174
Stressors × cognitive requirements						.29	.0115	3.135**
Stressors × learning requirements						−.12	−.0068	−1.315
Stressors × communication requirements						.05	.0018	0.493
Stressors × democracy						−.14	−.4666	−1.450
Stressors × openness to criticism						.09	.5005	0.988
Stressors × competition						.02	.1062	0.230
Stressors × dominance						−.08	−.3442	−0.887

[a] $p < .10$; * $p < .05$; ** $p < .01$.

Table 4. Multiple regression of perceived pressure on stressors, other work characteristics and quality of team interaction

Predictor	R	R^2	F	R^2_{inc}	F_{inc}	Partial corr.	B	t_B
Step 1	.713	.508	12.185**	.508	12.185**			
Stressors						.65	.6528	9.347**
Control at work						−.07	−.0492	−0.779
Complexity of work						.20	.1563	2.271*
Cognitive requirements						−.01	−.0002	−0.093
Learning requirements						.15	.0034	1.639
Communication requirements						.04	.0007	0.463
Democracy						−.05	−.0768	−0.490
Openness to criticism						−.16	−.4121	−1.781[a]
Competition						−.02	−.0500	−0.254
Dominance						−.10	−.1931	−1.065
Step 2	.760	.578	7.8630**	.070	2.014*			
Stressors × control at work						−.11	−.1923	−1.195
Stressors × complexity of work						.14	.2002	1.479
Stressors × cognitive requirements						.17	.0058	1.829[a]
Stressors × learning requirements						.19	.0089	2.015*
Stressors × communication requirements						−.12	−.0038	−1.233
Stressors × democracy						−.09	−.2486	−0.903
Stressors × openness to criticism						.03	.1502	0.346
Stressors × competition						−.17	−.6967	−1.763**
Stressors × dominance						.08	.2750	0.828

[a] $p < .10$; * $p < .05$; ** $p < .01$.

But, when stressors are high there may be too much challenge, resulting in high burnout scores. Thus, with respect to lack of identification, hypothesis 4 was partially supported by the data, while hypotheses 3 and 5 were not supported.

Table 4 shows that 51 per cent in the variance of perceived pressure was explained by stressors, other work characteristics, and quality of team interaction measures. Stressors showed the strongest relationship to this burnout factor. One reason for this pattern may be a conceptual overlap between stressors and perceived pressure (cf. Kasl, 1978). Another reason may be that the experience of perceived pressure is a clear outcome of stressors while lack of identification has several different 'causes'. Contrary to hypothesis 2, complexity was positively related to perceived pressure. This indicates that complexity in the work situation of software professionals is not only a favourable factor. High complexity goes hand in hand with identification with one's job, but is at the same time related to the experience of pressure. Additionally, the effect of openness to criticism on perceived pressure was marginally significant. Thus, the analysis shows that with respect to perceived pressure, hypothesis 1 was supported, while hypothesis 2 was partially contradicted.

When entering the interaction terms into the regression equation an incremental R^2 of .07 resulted. Again, the regression coefficient of the significant interaction effect of stressors × cognitive requirements revealed a positive sign. The same pattern was found for the interaction effect of stressors × learning requirements, indicating that high cognitive and high learning requirements enhanced the already strong relationship between stressors and perceived pressure. Thus, hypothesis 4 was partially supported by the data.

In addition, a significant interaction effect between stressors and competition was found. The negative sign of the regression coefficient indicates that for persons in teams with a low level of competition, the relationship between stressors and perceived pressure was stronger than for those working in high-competition teams. This finding is in direct opposition to hypothesis 5. One explanation for this result might be that in the case of a highly stressful situation the requirements related to positive team interactions and low competition (i.e. discussions, mutual understanding) might be an additional burden hindering coping with stressors. Another interpretation of this result can be derived from the concept of 'group think' (Janis, 1972), which says that highly cohesive groups produce strong group norms and therefore show less successful problem-solving behaviour when stress occurs[2]. This assumption was supported by the data: in this analysis, group cohesion was operationalized as the standard deviation of competition within each of the teams. This standard deviation was then correlated with the aggregated competition measures resulting in $r = .58$ ($p < .01$) at the team level. According to this operationalization, in low-competition teams little variability within the team was found, which can be seen as a sign of the 'group think' phenomenon, thus making it difficult to deal with stressful situations. Again, there was no empirical support for hypothesis 3, which predicted a mitigating effect of control at work on the relationship between stressors and burnout.

Overall discussion

This study found that in software development, work stressors are positively related to lack of identification and perceived pressure. This finding is in accordance with the results

[2]We would like to thank an anonymous reviewer for this interpretation.

of studies in other professional fields (Etzion, 1984; Friesen & Sarros, 1989; Russell *et al.*, 1987). In addition, other variables were also found to have significant relationships with burnout, especially with lack of identification. Thus, burnout is not only associated with stressful situations but also with a lack of positive features in the work situation, such as control at work or openness to criticism within the team.

A further purpose of this study was to examine potential moderating effects. Cognitive and learning requirements showed enhancing effects, while competition reduced the negative effects of stressors. This pattern indicates that high requirements and low competition make a stressful situation even worse. The nature of the moderating effect found for competition seems to contradict the results of studies finding desirable moderating effects of social support (e.g. Etzion, 1984; Russell *et al.*, 1987). However, it must be noted that in the present study quality of team interaction, not social support, was measured. Therefore, competition may be positive because one can individually deal with the problems at hand and shut out demands and discussions with others when stress is high.

Our cross-sectional design does not allow the testing of causal patterns. Moreover, the results found in questionnaire-based studies may be due to common method variance (Campbell & Fiske, 1959; Frese, 1985; Kasl, 1986). Although it would be optional to study the stressor–burnout relationship on the basis of observational data using a longitudinal design, certain checks can be made within the framework of our study. Cognitive, learning and communication requirements were ascertained during an interview while burnout was assessed with a questionnaire scale. The zero-order correlations between job requirements and burnout were indeed lower than were some other correlations but some relationships were still significant and significant moderator effects were also found for cognitive and learning requirements. Thus, not all of them can be dismissed as the result of common method variance. However, we tend to agree that the correlation between stressors and perceived pressure may have been enhanced by common method variance. Zapf (1989) has shown in LISREL analyses that, although the use of questionnaire scales increases correlations between stressors and psychological impairment scales, these correlations cannot be completely accounted for by common method variance.

Another weakness of questionnaire studies lies in possible individual response biases leading to an overestimation of the correlations between two variables. In order to rule out this possibility, aggregated measures of quality of team interaction were used. Again, main and moderator effects were found, indicating that not all results were due to individual response biases.

Although it is difficult to provide conclusive answers to practical issues based on data from a cross-sectional study, there are practical implications. While we do not know the causal path, there were clear relationships between stressors, low control, low openness to criticism within the team and burnout. High requirements in the job were found to be negative when combined with high stressors. If further research shows this relationship to be due to causal effects, preventing burnout among technical professions would seem to require a reduction in the level of stressors because high cognitive and learning requirements are inevitable in many of these jobs.

Finally, the study showed burnout to be a relevant psychological strain variable in the technical field, so its consideration should not be restricted to the psychosocial professions. Our results may have implications for research on burnout in other areas. Since burnout may occur even where there is no contact with clients or with students, the

burnout phenomenon may need a broader conceptualization with more attention being paid to working conditions that can be generalized across a broader range of professions.

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