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Eight- and twelve-hour shifts in Austrian rail traffic controllers: a psychophysiological comparison

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Abstract

The present study compared a 12-hour and an 8-hour shift system in 18 Austrian rail traffic controllers. To gain objective indicators for arousal and fatigue induced by the whole work-rest sequence, we recorded heart rate during the last night shift, in addition to subjective measures that included physical symptoms. A higher increase of monotony, fatigue and saturation emerged during the 8-hour compared to the 12-hour regime, together with a heart rate decrease during the last 8-hour night shift. In line with other researchers, we conclude that flexible working conditions in specific occupational groups may compensate for disadvantages of prolonged working periods, giving way to advantages of longer shifts such as longer pauses and extra days off for social and other personal activities.

Key words: Night shift regime; 8 vs. 12-hour shift; fatigue; psychophysiology; rail traffic controllers

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Introduction

Shift work is an inevitable part of many jobs which require 24-hour attendance and comprise working at unusual hours, especially at night. Because of potential hazards of night shift work on safety and health, there was an intensive debate on the "best compromise" shift system (Folkard, 1992). Shift length and kind of shift rotation (forward/backward rotation; quick and slow rotation) have been considered at length (Smith, Folkard, Tucker & Macdonald, 1998). Up to now, no unequivocal conclusion can be drawn with respect to shift length. One reason might be that mediating factors play an important role, such as length of recovery intervals between shifts, options for sleep recovery in these intervals, options to cope with fatigue within the shift, or personal and family activities, all of which contribute to cope with work stress (Folkard, 1992; Smith et al., 1998). Earlier in this debate, there was a focus on circadian rhythm. For example, Knauth and Rutenfranz (1982) who compared shift systems with different rotation recommended fast rotation because it was least disruptive with respect to circadian rhythm. This has been challenged by Wilkinson (1992) who concluded in his comprehensive review that slowly rotating shift systems with longer shifts are superior to fast rotating systems with shorter shift duration, since they may improve psychological wellbeing and health, and reduce tiredness throughout the work period. A more recent review (Smith et al., 1998) came to a similar conclusion, stating advantages in the 12-hour shift system with respect to lower stress levels, better physical and psychological wellbeing, improved quality and duration of sleep as well as improvements in family relations. However, concerns remained on the fatigue and safety side. Although research findings remained equivocal, an 8-hour limit for shift duration was recently recommended for all kinds of occupations by the European legislation (European Union, 2003). Despite these regulations, longer shifts still persist at some work places in Austria and are liked by the workers because of positive consequences such as having more days off per week.

Extending the shift length to more than 8 hours may increase fatigue and performance decrement, as reported by Rosa, Colligan & Lewis (1989). Their control room operators showed a time-on-shift related performance decrement in laboratory-type tasks (mental arithmetic and grammatical reasoning while simultaneously monitoring a signal) and an increase in subjective sleepiness seven months after the change from an 8-hour to a 12-hour shift regime. A 3.5-year follow-up revealed persistent decrements in performance and alertness (Rosa, 1991). However, after the first seven months, improvements in performance were seen across the shorter workweek in the 12-hour shift, indicating that workers may have the capability to cope with longer shift durations (Rosa, Colligan & Lewis, 1989).

Several studies revealed no serious disadvantages or even advantages of an extension to 12-hour shift duration. Lowden et al. (1998) showed that reaction time performance, perceived accident risk and health were not negatively affected 10 months after changing from 8- to 12-hour shifts. In addition, workers reported increased satisfaction with work hours, sleep and time for social activities. In another study with control room operators, Axelsson et al. (1998) compared two groups of 8- and 12-hour shift workers over three weeks. Main effects of shift length were either non significant or in favour of the longer shifts, while an interaction of shift length and time of day indicated increased sleepiness in 12-hour night shifts, but sleepiness was lower during the 12-hour morning shift compared with the 8-hour morning shift. In addition, there were no performance differences in both reaction time and vigilance. A subgroup analysis revealed that increased sleepiness in the 12-hour night shift was associated with a decreased physical workload during night. Tucker, Barton & Folkard (1996) performed a comparison between two groups of chemical workers, being either on 8- or 12-hour shifts. The observed differences in a questionnaire revealed significantly less cardiovascular complaints, social disruption and job dissatisfaction for the 12-hour shift workers. No differences in chronic fatigue were found, but alertness ratings were significantly lower in the 12-hour group during periods of night work being close to the end of their shift.

No clear advantages of either shift regime were obtained by Frese & Semmer (1986) who compared large groups of German blue-collar workers with 8-hour and 12-hour shifts. Differences between the two shift regimes were generally low. Twelve-hour workers were slightly healthier, reported marginally significantly less psychosomatic complaints and irritation, significantly fewer health complaints during the last two years, and a somewhat smaller degree of environmental stress compared with 8-hour shift workers. However, the difference disappeared when results were controlled for confounding factors such as age and job skills. In a more recently performed study, Williamson, Gower and Clarke (1994) did not find any adverse affects of changing from an 8-hour to a 12-hour shift in Australian computer workers. Despite working 50 percent longer per shift, the 12-hour group was less tired and felt fresher at the end of the shift. No adverse effects on productivity and safety were observed, since workers committed no more errors per hour compared to the 8-hour regime. In addition, they reported a reduced prevalence of psychological distress, displayed a better ability to unwind after work and showed significant improvements in physical and psychological health symptoms. This was especially the case for symptoms known to be most affected in shift workers, namely gastrointestinal and sleeping problems (Cervinka, 1993).

Kirchler and Schmidl (2000) compared Austrian rail traffic controllers (RTCs) working in 8-hour shifts with RTCs following a 12-hour shift regime. Both shift cycles were part of a short rotating system, with three 8-hour shifts within four days and three 12-hour shifts within 12 days. During the first third of their shift, both groups did not differ significantly in fatigue. Thereafter, fatigue increased markedly during the 8-hour shift but only moderately during the 12-hour shift. In addition, at the end of the 8-hour shift there was a much higher error rate in performance tests compared to the 12-hour shift. Similar to Williamson et al. (1994), the authors used an increase of rest break duration which comes with increasing shift length in the 12-hour group as a possible explanation for an increase in their capacity to counteract fatigue and performance decrement. The 12-hour shift has been also more popular because of reduced commuting time requirements and because of longer leisure periods that can be used for personal interests. In addition, the longer rest breaks between 12-hour shifts offer better options for night sleep recovery.

So far, most studies comparing short shifts with longer shifts restricted themselves to subjective and performance measures. However, since psychophysiological dysfunctions may result from disturbances in the circadian rhythm and sleep deprivation (Smith et al., 1999; Janssen & Nachreiner, 2003) the use of physiological measures is of great importance (Boucsein & Backs, 2000). Furthermore, a combination of shift work, decrease in decision latitude and low social support, which is not unusual in shift work, is not only a candidate for loss of job satisfaction and well-being, but may have as severe consequences as life threatening cardiovascular disorders (Karasek & Theorell, 1990). Therefore, job related personality variables should be taken into account as well.

In Austria, the traditional shift regime for RTCs was 12 hours. Because of international regulations, 8-hour shift regimes were introduced for a part of the Austrian RTCs about two years before the present study started. Another part of Austrian RTCs, however, decided to adhere to the 12-hour shift regime. The present paper compares such a persisting fast rotating 12-hour shift system with a recently introduced fast rotating 8-hour shift system in Austrian RTCs – a combination of train movement and station inspectors – following a psychophysiological approach, i. e., combining subjective with physiological indicators of stress and fatigue. Our hypothesis, mainly based on the results of Kirchler and Schmidl (2000), was that a 12-hour shift can be superior to the usual 8-hour shift for the specific occupational group of RTCs.

To complement subjective measures of monotony, fatigue and stress, we used recordings of cardiovascular activity during the last shift to gain objective indicators for arousal, stress and fatigue induced by the whole work-rest sequence. Since night shift workers often complain about physical symptoms such as restlessness or tension (Härmä et al., 1998), a symptom list was applied. In addition, personality related questionnaires were used.

Methods

Subjects and tasks

The present study was conducted with 18 male volunteer Austrian RTCs, nine of whom worked permanently on an 8-hour-shift, the other ones permanently on a 12-hour shift in different locations of southern Austria. The latter group was slightly older (M=43.11, SD=4.62 years) than the 8-hour group (M=40.56, SD=4.59 years) and significantly longer employed as RTCs (M=25.33, SD=5.92 years, compared to M=21.89, SD=4.51 years, p<.05). 44,4% of the 12-hour group had a university-entrance diploma compared to 55,6% in the 8-hour group.

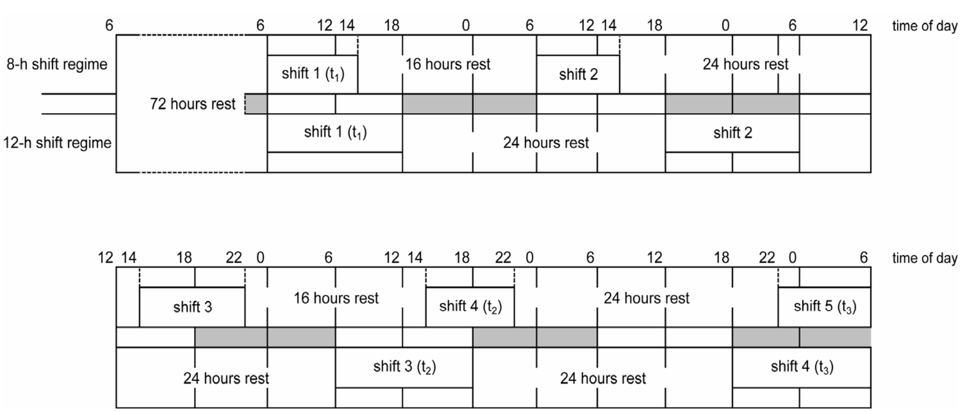

Figure 1:
Shift/rest schedule for the 8-hour shift regime (upper bars) and the 12-hour regime (lower bars). The gray bars in the middle indicate nights

Figure 1 shows the shift/rest period schedules for the two groups. The RTCs worked in middle-sized towns (Graz and Villach) with comparable tasks to be performed. The observation period for each group started after and ended with a 72-hour rest period. The 12-hour shift was interrupted by 24-hour rest periods, while 16- and 26-hour rest periods alternated during the 8-hour shift schedule. As can be inferred from Figure 1, the 8-hour shift system comprised more shifts but less working hours compared to the 12-hour system.

During their shifts, the RTCs alternated between different tasks. The majority of time was spent with traffic observation and guidance (electronically securing the train rides, setting signals and switching forks), communication by phone and email (blocking and clearing tracks, announcing trains to stations, informing about construction works and unusual events), and documentation. In between, the RTCs irregularly went to the platforms to supervise train departures.

Data collection and analysis

Each RTC was given a diary and a set of questionnaires. After being acquainted with the material by the experimenter (the third author), the RTCs were asked to carry the diary with them during the whole shift and their leisure time. At the beginning of each shift, the Questionnaire for Analyzing Faulty Behaviours and Attitudes in Coping With Work Demands (FABA; Rotheiler et al., 2007), and a German adaptation of the Karasek Questionnaire of Experienced Job Demands and Decision Latitude (FIT; Richter et al., 2000) were administered, to gain work related personality variables. At the beginning and at the end of each shift, a German questionnaire for work related subjective stress (BMS; Plath & Richter, 1994) and a German physical symptom list (Multiple Physical Symptom List, MKSL; Erdmann & Janke, 1976) had to be filled in. After the last shift, the RESTQ (Kallus, 1995; Kellmann & Kallus, 2001) was given.

About one hour before the end of the second last shift, the experimenter showed up to introduce the device for the ambulatory monitoring of HR for the last shift. The electrode attachment was explained and carried out self-reliantly by the RTCs at the beginning of the last shift. Because of the restricted recording capacity, the device had to be replaced once during the last shift. Valid heart rate recordings were obtained for only 12 persons, since not all RTCs were ready to participate in the physiological recordings and some technical problems occurred. Heart rate variability (HRV) was computed as mean square of successive differences of inter-beat-intervals.

Statistical evaluations were carried out with ANOVAs for mixed designs, with groups as between- and shift as within-factors. This procedure ensured getting the differences in time courses between 8-hour and 12-hour shift regimes. Bonferroni corrections (Holm, 1979) were applied for ANOVAs. F-values were Greenhouse-Geisser corrected to account for inhomogeneity of variances. The significance level was set to $p<.05$.

Results

Subjective stress and shift duration

Table 1 shows the results from the BMS scales that were filled in at the end of each shift. Comparisons were made for the first, the penultimate, and the last shifts from each group. As can be inferred from Figure 1, the second shifts were too different (morning vs. night shift) and too far apart, and there was no adequate comparison for the third shift in the 12-hour regime in the 8-hour group.

As can be seen in the first column of Table 1, there was no considerable group difference at the end of the first shift for monotony. Until the end of the penultimate shift, the 8-hour group reported a slight increase of monotony, whereas the 12-hour group showed a decrease. Both groups reported a marked increase of monotony from the end of the penultimate to the end of the last shift. However, subjects working according to the 12-hour shift system reported significantly less monotony at the end of the last two shifts than their 8-hour counterparts. The group difference in developing monotony is reflected in significant differences of the linear ($F=9.13$; $df=1/13$, $p=.010$) and quadratic trends ($F=10.21$; $df=1/13$, $p=.007$) over shifts. Fatigue and saturation (second and third columns in Table 1) showed similar results, with interactions between group and shift becoming significant as well. Even though the 8-hour group reported less fatigue at the end of their first shift, they were much more tired at the end of their last shift compared to the 12-hour group. The effects for stress look similar but remain insignificant (last column in Table 1).

Table 1:

Means of subjective stress reports (BMS) at the end of shifts t_1, t_2 and t_3 for the 8-hour and the 12-hour shift groups. Scoring adjusted; high values correspond to an increase of the attribute

	BMS Scales							
	Monotony		Fatigue		Saturation		Stress	
End of shift	8-hour	12-hour	8-hour	12-hour	8-hour	12-hour	8-hour	12-hour
t_1	43.90	42.59	40.23	44.30	42,02	42,37	40,61	42,06
t_2	44.51	37.74	47.55	41.46	47,39	41,76	42,24	41,10
t_3	53.43	46.35	52.86	45.13	56,30	46,29	44,83	41,48
F over shifts (t_1, t_2, t_3)	9.58		9.34		13.87		0.74	
df	1.36 / 17.74		1.55 / 21.76		1.95 / 27.32		1.71 / 23.93	
p	.004		.002		.001		.467	
F over shift groups (8 hours vs. 12 hours)	7.82		2.24		4.94		0.57	
df	1.00 / 13.00		1.00 / 14.00		1.00 / 14.00		1.00 / 14.00	
p	.015		.156		.043		.462	
F interaction shifts/groups	1.40		8.38		4.60		1.79	
df	1.36 / 17.74		1.55 / 21.76		1.95 / 27.32		1.71 / 23.93	
p	.264		.004		.020		.191	

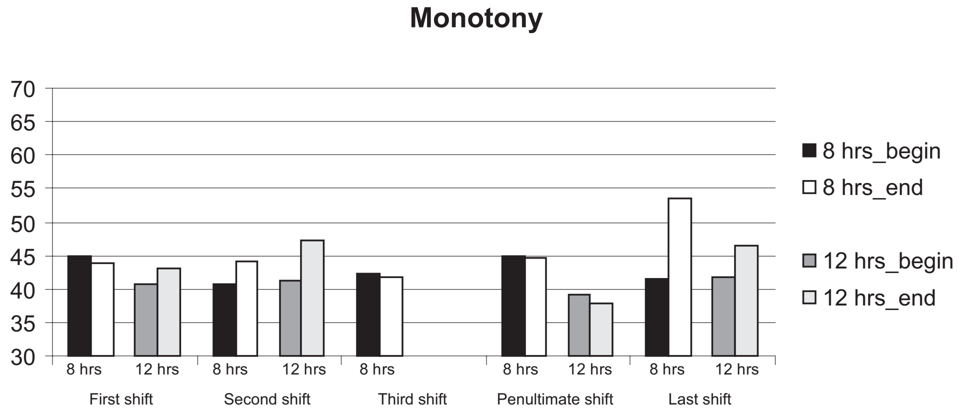

Figure 2:
Subjectively reported monotony (BMS) at the beginning and the end of each shift for the 8-hour and 12-hour shift regimes. Note that the penultimate shift is shift 4 in the 8-hour group and shift 3 in the 12-hour group (see Figure 1)

Figure 2 depicts the changes of monotony from the beginning to the end during all shifts for both shift regimes. There was no significant change in monotony for shift 1. During the second shift, monotony increased in both groups. Such an increase was not present in shift 3 (only 8-hour group) and in the penultimate shifts for both groups. In the latter shift, the 12-hour group showed generally lower monotony compared to the 8-hour shift. Both groups reported an increased monotony during their last shift, being more pronounced in the 8-hour group. Because of the different numbers of shifts in the two groups, statistical tests were performed for the 8-hour and the 12-hour regimes separately. The group difference in the development of monotony for the 8-hour shift was reflected in significant linear ($F=9.13$; $df=1/13$, $p=.010$) and quadratic trends ($F=10.21$; $df=1/13$, $p=.007$) over shifts. No significant effects emerged for the 12-hour group.

Figure 3 depicts the changes in fatigue in the same manner as Figure 2 for monotony. Except for the 8-hour group in shift 1 and the 12-hour group in the penultimate shift, fatigue increases were reported in all instances. Such an increase was especially prominent for the last two shifts in the 8-hour regime. The increase of fatigue during the shifts in the 8-hour group started with the second shift and was most pronounced during the last shift, with a linear trend being highly significant ($F=19.46$; $df=1/6$, $p=.005$). In the 12-hour group, no such overall trend became significant.

The corresponding results for saturation are shown in Figure 4. There was also a steady increase in saturation for the 8-hour group (with $F=25.76$; $df=1/6$, $p=.002$, for the linear trend). For the 12-hour group, saturation was significantly higher at the end as compared to the beginning of the shift cycle, with a significant linear trend ($F=7.72$; $df=1/8$, $p=.024$). Since the stress scale did not reveal any significant differences, results are not depicted here.

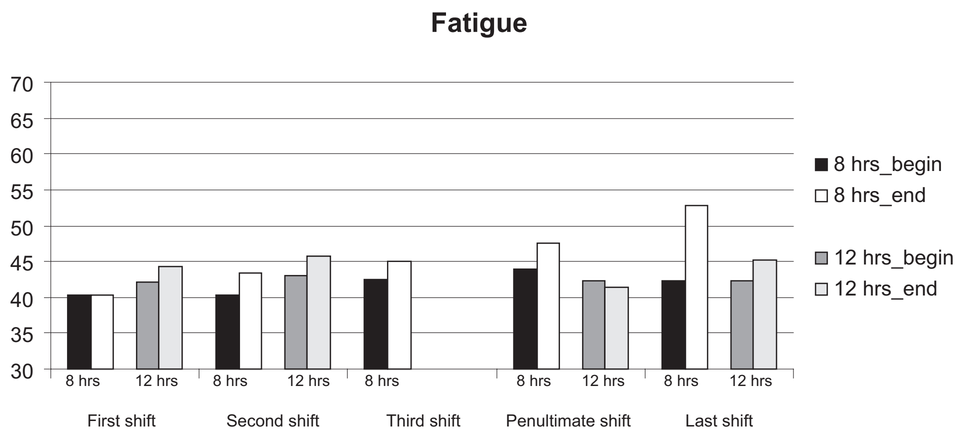

Figure 3:
Subjectively reported fatigue (BMS) at the beginning and the end of each shift for the 8-hour and 12-hour shift regimes. Note that the penultimate shift is shift 4 in the 8-hour group and shift 3 in the 12-hour group (see Figure 1)

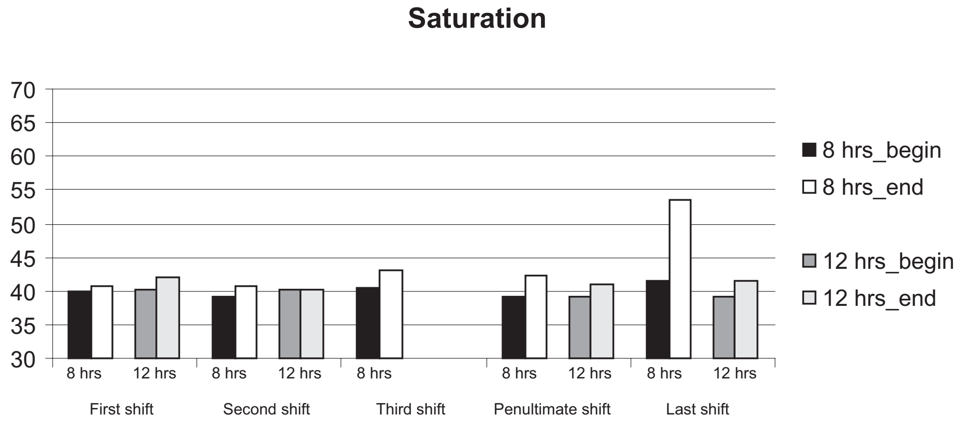

Figure 4:
Subjectively reported saturation (BMS) at the beginning and the end of each shift for the 8-hour and 12-hour shift regimes. Note that the penultimate shift is shift 4 in the 8-hour group and shift 3 in the 12-hour group (see Figure 1)

Physical symptoms and shift duration

Table 2 shows the results from the MKSL scale that was filled in at the end of each shift. Like in Table 1 and for these same reasons, group comparisons were made only for the first and the last two shifts of both groups.

The only physical symptom for which the shift duration effect became significant was relaxation, being generally higher in the 12-hour shift group. The significant decrease of relaxation over shifts was most pronounced under the 8-hour shift regime, and the interaction was also significant. Physical tension mirrored these effects, without significance of shift duration. Symptoms of physical pain were on almost the same low level in both groups at the end of the first shift, but increased significantly under the 8-hour regime towards the end of the last two shifts. The significant group/shift interaction reflects a considerable lower increase of subjectively reported pain under the 12-hour shift regime.

Figure 5 depicts the course of the heart rate (HR) during the last shift which was a night shift for both groups. Note that the 8-hour shift did not start before 22:00 hrs. Therefore, the HR peak seen in the first part of figure 5 is not due to work but to other activities. The group main effect was highly significant ($F=10.00$; $df=1/16$, $p < .001$), due to the HR in the 8-hour shift being markedly lower, especially during the second half of the shift (mean HR = 67.56), compared to the 12-hour shift (mean HR = 71.11). There was no significant interaction between course and group ($F=1.51$; df=2,619/41,896, $p=.218$). Figure 6 shows the course of heart rate variability (HRV) which was insignificant ($F=1.00$; $df=1/16$, $p=.433$) but showed a

Table 2:

Means of reported physical symptoms (MKSL) at the end of shifts t_1, t_2 and t_3 for the 8-hour and the 12-hour shift groups

	MKSL scales: symptoms of physical							
	Tension		Relaxation		Pain		Sickness	
End of shift	8-hour	12-hour	8-hour	12-hour	8-hour	12-hour	8-hour	12-hour
t_1	0.48	0.58	4.20	4.33	0,82	0,74	0,15	0,15
t_2	1.12	0.39	2.93	4.39	2,00	0,44	0,19	0,04
t_3	1.28	0.75	2.69	3.83	2,19	0,82	0,33	0,11
F over shifts (t_1, t_2, t_3)	8.96		11.43		1.21		0.28	
df	1.93 / 26.99		1.94 / 27.12		1.40 / 19.57		1.72 / 24.13	
p	.001		< .001		.305		.72	
F over shift groups (8 hours vs. 12 hours)	1.62		5.05		1.73		0.39	
df	1.00 / 14.00		1.00 / 14.00		1.00 / 14.00		1.00 / 14.00	
p	.224		.041		.210		.538	
F interaction shifts/ groups	5.95		7.49		4.17		0.76	
df	1.93 / 26.99		1.94 / 27.12		1.40 / 19.57		1.72 / 24.13	
p	.008		.003		.043		.462	

tendency towards a significant interaction between course and group (F=2.18; df=1/16, p=.061), due to an increase of HRV during the 12-hour shift and a decrease during the 8-hour shift.

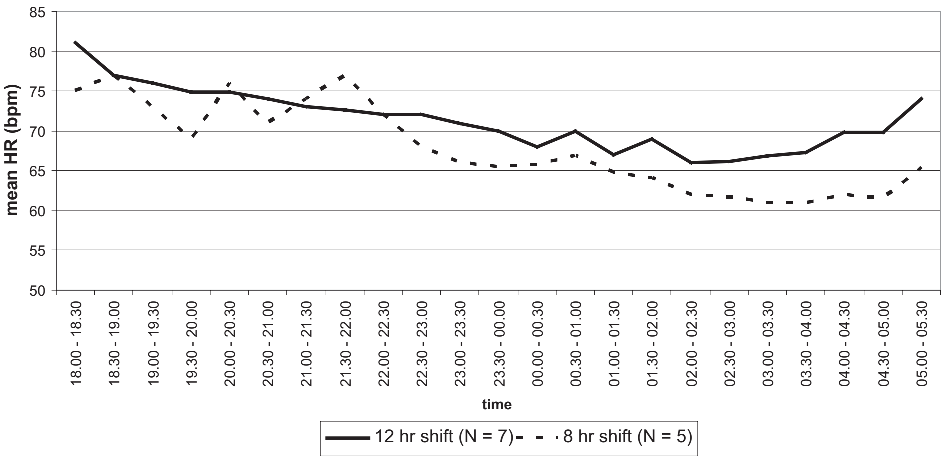

Figure 5:
Heart rate during the last night shift for the 8-hour shift group (broken line) and the 12-hour shift group (solid line) between 18:00 and 5:30 hrs

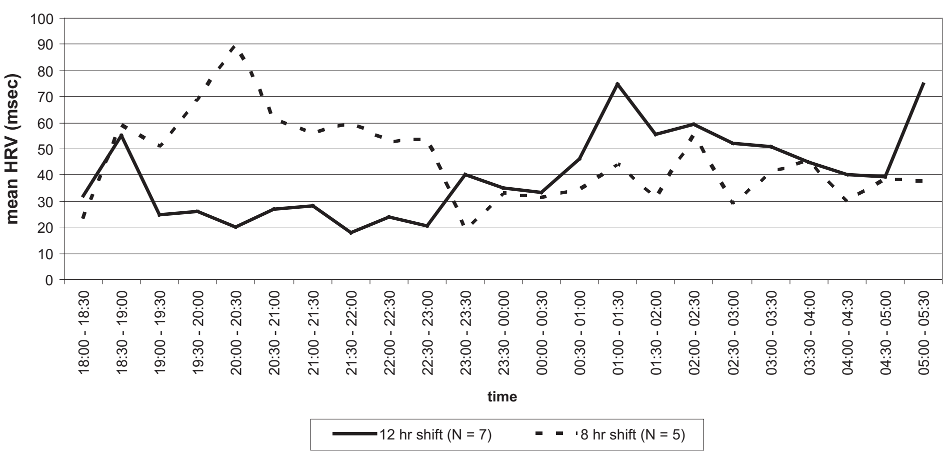

Figure 6:
Heart rate variability during the last night shift for the 8-hour shift group (broken line) and the 12-hour shift group (solid line) between 18:00 and 5:30 hrs

Personality related variables

For each FABA scale, a median split was performed to dichotomize our subjects for evaluating the RESTQ scales “strain” and “relaxation” that were filled in at t_3. With the resulting groups as a first factor and eight- vs. 12-hour shift regimes as a second one, two-way ANOVAs were calculated. Subjects with high “inability to unwind” reported significantly higher strain compared to those unwinding easier (F=8.62; df=1/14, p=.011). There was a highly significant interaction for “dominance/competition” (F=11.32; df=1/14, p=.005), reflecting that in the 12-hour shift condition, RTCs with high dominance/competition reported a lower amount of strain compared to their less dominant/competitive colleagues, while the opposite was seen in the 8-hour shift. “Excessive planning needs” and “reactive uncontrol” did not reveal any significance. No significant group effect emerged for the two FIT variables “decision latitude” and “job demands.”

Discussion

The present study compared a series of five 8-hour shifts with a series of four 12-hour shifts in rail traffic controllers who performed comparable tasks. Such a comparison was enabled by different regulations for Austrian RTCs in different regions. Although comparisons of 8- and 12-hour shift systems in RTCs are not new to the field, knowledge could be enlarged by obtaining psychophysiological recordings from a subgroup of participants in addition to the usually performed subjective reports and by taking into account job related personality variables.

Subjective reports at the end of three comparable shifts emerge a significantly higher increase of monotony, fatigue and saturation during the 8-hour compared to the 12-hour regime (Tab.1), which is in accordance with the results of Kirchler and Schmidl (2000). Working for 12 hours normally induces more fatigue than an 8-hour shift, which can be seen in the first shift (figure 3). For the inverse relation seen in the last shift influencing factors other than the shift duration might be considered as a possible explanation. As can be inferred from Figure 3, the difference in subjectively reported fatigue is most pronounced during the last shift in the series. The same holds for monotony (Fig. 2) and saturation (Fig. 4). It is likely that the second half of the last 8-hour shift is critical here, since a significantly higher decrease in HR emerges compared to the equivalent period in the last 12-hour shift. This matches the picture of an increased fatigue (Fig. 5), because such a HR reduction indicates a decrease in general arousal during night shift work (Boucsein & Ottmann, 1996), and was also observed during night shifts in train drivers by Torsvall and Akerstedt (1987).

At first glance, the observation that RTCs in the 12-hour group, unlike their 8-hour counterparts, maintained their level of HR until the end of the last night shift could be interpreted as sign for increased stress level in the former group. This is not only challenged by a lack of significant differences in the BMS stress scale (Tab. 2), but also by higher HRVs in the second half of the last shift compared to the 8-hour group (Fig. 6), although the group by time interaction effect failed to reach significance. A higher HRV in the 12-hour group may point to the possibility that workers under this regime needed less effort for working and staying awake than their 8-hour shift counterparts. In the 8-hour group, lower HRV might have reflected greater mental effort needed for continuing their work (Veltman & Gaillard, 1993). Although the results of our physiological measures should be treated with caution because of the small number of subjects, they can well stand within the literature on shift work, where fine-grained evaluations were also performed with small samples (e.g. Lowden et al., 1998).

Our results are in line with those from an earlier study with Austrian RTCs (Kirchler & Schmidl, 2000), where fatigue increased markedly during the 8-hour shift but only moderately during the 12-hour shift, and also with those from a study with Australian computer workers (Williamson, Gower & Clarke, 1994), where an increase of subjectively reported freshness appeared as a consequence of changing from an 8-hour to a 12-hour shift regime. We agree with the authors of these two studies insofar, as at least part of the 12-hour shift regime's benefit found in our own study can be directly related to the duration of pauses between shifts. While RTCs working on the 12-hour shift regime always had a minimum of 24-hour rest break after each shift, RTCs who worked on an 8-hour regime had two recovery periods of only 16 hours (Fig. 1). Although both groups worked a total of 24 hours in night shifts, the 8-hour group spent three consecutive (at least partial) nights at work (shifts 3, 4, and 5), while the 12-hour shift comprised only two (non-consecutive) working nights (shifts 2 and 5).

As can be inferred from Figure 1, workers under the 8-hour regime may have ended up in two consecutive nights with restricted sleep before the final night shift, since part of the resting hours might have been eaten up by an increase in commuting. Contrarily, the 12-hour shift regime had 24 hours rest (including a full night) before their last shift, which allowed for better unwinding and relaxation. Such an extended pause may have contributed to lower reports of fatigue in the 12-hour shift group at the end of the final shift, despite the fact that this group worked altogether 8 hours longer than the 8-hour shift group. As Williamson et al. (1994) pointed out, extending the shift to 12 hours is particularly attractive for many workers because it maximizes the length of pauses and minimizes commuting, an advantage which was also discussed by Kirchler and Schmidl (2000). Thus, the workers have more opportunities to recover and to spend more time for leisure activities. In addition, the 12-hour regime allows for a more optimal distribution of shifts across morning, evening and night.

The results of asking our RTCs to report on physical symptoms during their work are shown in Table 2. Pain symptoms increase more during the 8-hour compared to the 12-hour shift regime, as shown by the significant interaction effect. This is in accordance with findings of Rosa et al. (1989) whose subjects reported increasing gastro-intestinal problems during either shift regime but less symptoms of this kind after switching from an 8-hour to a 12-hour shift. As can further be inferred from Table 2, significantly more relaxation and less activation symptoms were reported during the 12-hour regime, which again supports a possible explanation of external factors such as longer pauses and more time-off days positively influencing subjective reports in the long shift regime.

As the study performed by Kirchler and Schmidl (2000), the present study used Austrian RTCs as subjects. It has to be taken into account that – different from many shift work jobs with limited degrees of freedom – these RTCs have the opportunity to temporarily change their job characteristics. During their shift, they are allowed to move from a computer-screen dominated work place to a livelier and socially more interactive part of their job, i.e., going to the platform to actually control the departure of trains. This may have helped them a lot to fight monotony, fatigue and saturation. The unusual large decision latitude provided for our subjects may partly restrict the possibility to generalize our results to other shift work places.

The present results further challenge the notion of a general superiority of 8-hour night shifts over 12-hour regimes, which had been already aimed at by Williamson et al. (1994) and Kirchler and Schmidl (2000), and also partly by Rosa et al. (1989). As Frese and Semmer (1986) pointed out, the 12-hour regime may require a special option that helps to counteract an increase of stress during prolonged work. The opportunity of temporarily switching to other activities of their job with different characteristics such as controlling the actual train departures may constitute such an option for our RTCs, since it has the power to reduce monotony. Thus, in addition to looking for interactions between shift regime and shift course, work characteristics should be taken into consideration that may diminish adverse factors in shift work. Flexible solutions may allow for shift work regimes which compensate for disadvantages of prolonged working periods, giving way to advantages of longer shifts such as prolonged rest breaks and extra days off for social and other personal activities.

In accordance with the findings of Kirchler and Schmidl (2000), decision latitude and job demands did not significantly differ between the two shift regimes. In addition, the individual inability to unwind as obtained with the FIT did also not yield differences between our two shift groups. However, RTCs with a low ability to unwind reported higher amounts of stress at the end of the shift block compared with those unwinding better. Furthermore, RTCs with high dominance/competition reported less strain in the 12-hour shift compared to their less dominant colleagues, while the opposite was seen under the 8-hour regime. Because dominance/competition constitute personality traits with high social impact, RTCs scoring higher in this trait may have benefited more from the high decision latitude in the 12-hour shift teams than less dominant ones. According to informal observations, the members of the 12-hour shift make more frequently use of swapping activities between team members. Although our sample is rather small, the present results point to a possibly important influence of personality and team related variables on coping with different shift durations.

A critical point in the present study is that our RTCs could not be randomly assigned to one of the shift regimes. Therefore, uncontrollable personality and job situation related influences such as the observed significant difference in professional experience (e.g., the 12-hour group was slightly older and more experienced than their 8-hour counterparts) can not be ruled out as contributing to our results.

We conclude that the controversial results on shift duration (e.g., Smith et al., 1998) can be at least partly resolved, when other contributing factors like the duration of rest breaks, recovery processes and work organization within a shift are taken into consideration. However, the small group sizes and the specific occupational profile of our subjects pose limits on the generalizability of our results.

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