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ABSTRACT

In this study among airline pilots, we aim to uncover the work characteristics (job demands and resources) and the outcomes (job crafting, happiness and simulator training performance) that are related to burnout for this occupational group. Using a large sample of airline pilots, we showed that 40% of the participating pilots experience high burnout. In line with Job Demands-Resources theory, job demands were detrimental for simulator training performance because they made pilots more exhausted and less able to craft their job, whereas job resources had a favourable effect because they reduced feelings of disengagement and increased job crafting. Moreover, burnout was negatively related to pilots' happiness with life. These findings highlight the importance of psychosocial factors and health for valuable outcomes for both pilots and airlines.

Practitioner Summary: Using an online survey among the members of a European pilots' professional association, we examined the relationship between psychosocial factors (work characteristics, burnout) and outcomes (simulator training performance, happiness). Forty per cent of the participating pilots experience high burnout. Job demands were detrimental, whereas job resources were favourable for simulator training performance/happiness.
Twitter text: 40% of airline pilots experience burnout and psychosocial work factors and burnout relate to performance at pilots' simulator training.

Pilots are in many ways a unique occupational group. They have a professional responsibility to ensure the safety of the aircraft and its occupants. While working, pilots need to manually control the aircraft during critical flight phases, operate complex systems on board aircraft, work in close mutual cooperation with crew members and air traffic control, while dealing with increasing automation, and emergency situations which are often time critical (Bor, Field, and Scragg 2002). Moreover, pilots work on rotating and lengthy shifts in rather unfavourable environmental conditions of low humidity, small space, noise and light. They have to follow intense training, complete regular flight simulation and actual flight tests. These factors, intrinsic to the aviation environment and commercial operations, require pilots to be in good physical and psychological health. Yet despite this, up to now research on pilots has tended to focus on experienced fatigue or other specific health-related outcomes (e.g. Jackson and Earl 2006), rather than psychological health and well-being. This is problematic as diminished psychological health, like burnout, is related to performance decrements (for a review, Taris 2006).

In this study among airline pilots, we focus on burnout as an indicator of psychological health and aim to uncover the work characteristics that relate to the experience of burnout as well as the outcomes that may be related to burnout for this occupational group. Our first contribution is to uncover the levels of burnout among a large sample of airline pilots employed at a range of airline companies (from low-cost to traditional flag carriers) and operating different types of flights (from short- to long-haul flights). Based on the Job Demands-Resources theory (JD-R; Demerouti et al. 2001) that has been used to predict burnout in many other professions (overview Bakker and Demerouti 2017; Nahrgang, Morgeson, and Hofmann 2011), we focus on the specific demanding and motivating work characteristics that are relevant for the experience of burnout among pilots. Second, in order to uncover why it is important to care about pilots' burnout, we examine its link

to two important outcomes: pilots' happiness and simulator training performance. We focus on happiness, as happiness is related to success (Lyubomirsky, King, and Diener 2005) and makes people more productive (Oswald, Proto, and Sgroi 2015). Moreover, we focus on performance in flight simulator training because meta-analysis has shown that knowledge gained during simulator training is transferred to the work context (Vaden and Hall 2005). Finally, we not only examine whether burnout is related to these outcomes but also why this may be the case. We suggest that burnout diminishes happiness and performance at simulator checks/training because pilots lack the (energy) resources to adjust or craft their work characteristics such that these fit their preferences and facilitate their optimal functioning.

Burnout among pilots

The term burnout was first introduced in the 1970s by Freudenberger (1974) to describe the gradual emotional depletion and loss of motivation he observed among volunteers. Originally, scholars assumed that burnout was a response to chronic emotional and interpersonal stressors at work (Maslach, Schaufeli, and Leiter 2001). Later on, research confirmed that burnout is not exclusive for human-services as it represents a slow process of progressive loss of energy and enthusiasm (Leiter and Maslach 2006). In a study among regional airline pilots, Fanjoy, Harriman, and DeMik (2010) found that 32.6% of the sample population were identified as high burnout candidates. Although this study uses a rather small, non-representative sample of pilots, it indicates that the burnout syndrome is highly relevant for pilot populations.

Although there are several conceptualisations to capture burnout, they generally agree that burnout is consisted of two main symptoms: high levels of exhaustion and a distant/cynical attitude towards work (Demerouti et al. 2001; Maslach, Jackson, and Leiter 1996). In the current study, we used the Oldenburg Burnout Inventory (OLBI; Demerouti et al. 2001, 2003), which conceives burnout as a syndrome of work-related negative experiences, including feelings of *exhaustion* and *disengagement from work*. Exhaustion refers to general feelings of emptiness, overtaxing from work, a strong need for rest, and a state of physical exhaustion, whereas disengagement refers to distancing oneself from the object and the content of one's work and to negative, cynical attitudes and behaviours towards one's work in general (Demerouti et al. 2001, 2003). The advantage of the OLBI compared to other burnout instruments is that it includes both negatively and positively framed items which is recommended by conventional psychometric standards, as such instruments have a higher probability to avoid artefacts due to acquiescence tendencies. Moreover, the OLBI shows convergent validity with other burnout instruments (i.e. the MBI-GS, Demerouti, Mostert, and Bakker 2010) and has been found to predict long-term sickness absence (≥90 days) during the 44 months of follow-up (Peterson et al. 2011). The OLBI has been shown to be a better predictor of long-term health than of depression and anxiety. Therefore, it is appropriate for our study among pilots.

Job demands-resources theory

The JD-R theory was initially introduced to uncover the work characteristics that are responsible for the experience of employee burnout. According to the model, two broad categories of working conditions can be identified – job demands and job resources – that are applicable to various types of occupations in which employees work with things, information, or people. This makes the JD-R theory also applicable to pilots' work. *Job demands* are defined as those physical, psychological, social or organisational aspects of the job that require sustained physical and/or psychological effort and therefore they are associated with certain physiological and/or psychological costs (Demerouti et al. 2001), such as high work pressure and emotionally demanding interactions with customers. *Job resources* refer to those physical, psychological, social or organisational aspects of the job that are functional in achieving work goals, reduce job demands and the associated physiological and psychological costs, or stimulate personal growth, learning, and development (Bakker 2011; Bakker and Demerouti 2007, 2017), such as autonomy, performance feedback and opportunities for personal growth.

These two categories of job characteristics are important because they are the triggers of two fairly independent processes. Job demands are initiators of the health impairment process. They represent requirements that individuals have to fulfil by investing effort, which eventually consume energetic resources and can lead to exhaustion, and psychosomatic health complaints (e.g. Bakker et al. 2003; Hakanen, Bakker, and Schaufeli 2006) if they are too high or when they are prolonged. Job resources are initiators of the motivational process because they fulfil basic psychological needs, such as the needs for autonomy, relatedness, and competence, and therefore increase the willingness to invest effort (Bakker 2011; Nahrgang, Morgeson, and Hofmann 2011; Ryan and Deci 2000). Job resources are related to higher work motivation, and lower disengagement (Bakker and Demerouti 2007). The first study on the JD-R model showed that job demands were the unique predictors of exhaustion, whereas job resources were unique predictors of disengagement (Demerouti et al. 2001). Later studies have provided ample evidence for these dual pathways including various job demands and resources, and outcomes (Bakker, Demerouti, and Sanz-Vergel 2014).

Pilots are a unique occupational group, and their work is associated with a distinctive mixture of job demands and resources. We focused on two job demands: work to private life conflict and future insecurity. *Work to private life conflict*, referred to as not enjoying your time at work because you are preoccupied with domestic obligations. Pilots are often away from home for multiple days or experience long daily duty periods creating potential difficulties in managing home obligations. This is very likely to deplete energy due to physiological efforts needed to meet demands in different life domains. Work-family conflict consumes energy to deal with conflicting demands, and therefore, has been studied as a predictor of exhaustion although some studies position it as a mediator between demands and exhaustion (e.g. Demerouti, Geurts, and Kompier 2004). Longitudinal evidence suggests that the causal chain of job demands → work-family conflict → exhaustion is inadequate as these constructs are directly related over time (Demerouti, Bakker, and Bulters 2004). Regarding *future insecurity*, competition within the European airline industry has increased significantly since the deregulation of the airline market and this has resulted in a degradation of employment terms. The current degradation of employment terms together with strong competition between airlines may create uncertainty in the confidence of a pilot's future career.

The job resources that we focus on are developmental possibilities, social support and organisational support. *Developmental possibilities* for pilots are often limited to promotions in rank on-board and ancillary activities, since task variety in duties on board is low. Absence of prospects in career success can lead to frustration and becoming alienated (Lang 1985), which seems closely related to feelings of disengagement. *Social support* of colleagues is a functional asset in achieving work goals. Since pilots need to work safely and operate in a time-critical environment, teamwork is essential (Grote et al. 2010) making social support of colleagues an important job resource. Besides support from colleagues, having a positive *relationship with the organisation* is related to both job and organisational engagement (Saks 2006). When pilots are working they operate autonomously in the flight deck and are not physically present within the organisation, nor do they work under direct supervision or have regular meetings with their supervisor. Access to support from the organisation, when facing problems, is therefore, a valuable resource for pilots. Thus,

> *Hypothesis 1a*: Job demands (i.e. work to private life conflict and future insecurity) will be positively related to exhaustion.

> *Hypothesis 1b*: Job resources (i.e. developmental possibilities, social support, and relationship with the organization) will be negatively related to disengagement.

Burnout and job crafting

The question that arises is how burnout is related to happiness and performance outcomes. We propose that pilots who experience high levels of burnout will not engage in proactive strategies to shape their jobs, which have been referred to as job crafting (Wrzesniewski and Dutton 2001), and therefore, have more difficulties to meet outstanding performance levels. Job crafting is conceptualised in the JD-R model (Demerouti et al. 2001) as the changes employees make to balance their job demands and job resources with their personal abilities and needs (cf. Petrou et al. 2012; Tims and Bakker 2010). This occurs by expansion-oriented behaviours, i.e. seeking resources and seeking challenges and by contraction-oriented behaviours, i.e. reducing and optimising demands (Demerouti and Peeters 2017; Petrou et al. 2012). S*eeking resources* (e.g. performance feedback, advice from colleagues or the manager, maximising job autonomy) can be a form of coping with job demands or achieving goals and completing tasks. Hobfoll (2001) also suggests that a basic human motivation is directed towards the accumulation of resources, which are important for the protection of other valued resources. *Seeking challenges* may include behaviours, such as seeking new challenging tasks at work, keeping busy during ones working day, or asking for more responsibilities once assigned tasks have been finished. Csikszentmihalyi and Nakamura (1989) argue that when individuals engage in activities offering opportunities for growth, they seek challenges to maintain motivation and avoid boredom. *Optimising demands* was introduced by the Demerouti and Peeters (2017) and includes the simplification or optimisation of work processes to make them more efficient. Similar to the literature on shortcuts or work-arounds, optimising demands occurs when the accomplishment of a work goal is blocked or made more difficult because of dysfunctional work processes (Halbesleben et al. 2008). We focus on optimising demands instead of reducing demands which is the original conceptualisation of daily job crafting by Petrou et al. (2012). Optimising demands is more constructive and represents attempts to make work more efficient and to by-pass inefficient work processes whereas reducing demands is more reactive and represents attempts to avoid strenuous aspect of the job. Because of safety reasons and adherence to standard operating procedures, we expected that it would not be possible for pilots to eliminate strenuous aspects of the job but to work smarter by making the existing work processes more efficient.

Several scholars (Petrou et al. 2012; Wrzesniewski and Dutton 2001) suggest that even in the most stable environments with detailed job descriptions and clear work procedures, individuals can and do adjust the tasks they perform and mobilise the resources they need to carry out

their tasks successfully. Bakker and Costa (2014) suggest that employees high on burnout are less likely to profit from a gain spiral of daily job crafting. Such employees miss the energy and motivation to initiate job crafting behaviour. Therefore, they miss the opportunity to profit from a gain spiral in which resources accumulate over time. Burned-out employees are less open to new experiences and may be less able to focus on a variety of tasks because of their health problems including anxiety, sleep disturbance, memory impairment (Bakker and Costa 2014). This is also in line with the coping literature which shows that employees high on burnout are less likely to use active or problem focussed coping strategies (Demerouti 2015). Recent meta-analysis showed that both dimensions of burnout (exhaustion and depersonalisation, implying distancing oneself from recipients of one's services) were negatively, rather low but significantly, related to problem-focused coping and to seeking social support (Shin et al. 2014). Moreover, both burnout dimensions showed a similar pattern and strength of relationship with coping. Therefore, burnout experiences will make pilots less willing to show proactive behaviours in terms of adjusting their work environment even if such behaviours would help them to reduce these feelings, for example, when they would arrange job resources that would make their job more engaging. Thus,

> *Hypothesis 2*: Exhaustion will be negatively related to seeking resources (2a), seeking challenges (2b) and optimizing demands (2c).

> *Hypothesis 3*: Disengagement will be negatively related to seeking resources (3a), seeking challenges (3b) and optimizing demands (3c).

Towards happiness and training performance

We expect that burnout will be negatively related to *performance at simulator checks/training*. With burnout, an employee's mental and physical energy is depleted. Thus, employees are more likely to make mistakes and less likely to act safely (Nahrgang, Morgeson, and Hofmann 2011). Depending on what is at stake, people may also maintain levels of performance by using in extra compensatory effort. This last strategy should not be employed for too long, or too frequently, because the physiological and psychological costs of prolonged compensatory effort are high. Compensatory effort is typically accompanied by altered emotional states, such as anxiety, hostility or irritability, and cognitive changes, such as cognitive tunnelling, indecisiveness and lack of creativity (Wickens et al. 2004). These may lead to secondary costs that further aggravate the situation such as social conflicts. In the long term, the inability to replenish energy resources that were lost in an attempt to cope with demands (due to chronic or recurring

episodes of compensatory effort) may lead to long-term fatigue that impairs normal functioning on many aspects in daily life. Moreover, people fail to notice that they are becoming less flexible in responding to further demands (Gorgievski and Hobfoll 2008).

Being fatigued is related to a variety of performance decrements, and the increased probability of making errors; with increased time spent awake, during the circadian nadir times of the day, when experiencing difficult flight conditions, high density verbal exchanges, or under time pressure (Caldwell et al. 2009; Durmer and Dinges 2005). Recognising and adjusting to demands is of high importance to flight crew since Grote et al. (2010) found that when flight crew share a sense of heedfulness (i.e. deliberate efforts made by all team members to constantly reconsider the effects of their actions in relation to the goals and actions of others and to the broader context) they perform more effectively. It prevents team members from narrowly following strict operating procedures or relying on over-learned processes. When team members are confronted with high task loads (e.g. faced with an increase in demands) they cannot operate individually since it requires adaptive coordination. Thus, in order to perform effectively under all flight conditions and after long duties pilots need to have a fit mental and physical state.

Happiness concerns the general judgement of individuals of whether their life is happy or not, which is based on their affective responses to their life (Schwarz and Clore 1983). The pilot's job is assumed to have important effects on happiness with life in several ways. Work is the source of income that helps people to meet their needs and wants. In addition, for most people work accounts for a large number of waking hours per day, and there is evidence that work has a substantial influence on people's self-concept and self-esteem (Kahn 1981). The stressful effects of losing one's job, i.e. unemployment, are also well-documented (Warr 1987). Rice (1984) proposes that working conditions influence happiness through perceptions of the quality of working life and non-working life. Specifically, working conditions influence life satisfaction or happiness, by changing characteristics of the person or the environment. Such changes include short-term effects of work (e.g. mood, energy level and interests), and long-term effects of work (e.g. skills, personality and health). As burnout may be conceived of as a long-term consequence of work (Shirom 1989), it can be used as an indicator of the perceived quality of one's working life.

The hypotheses advanced earlier suggest that job demands and resources will be related to training performance and happiness through burnout and job crafting. First, to perform above standard during the simulator checks/training sessions and to live a happy life, pilots

must be able to utilise their full mental and physical capacities and to extend a large amount of effort. Unfortunately, in the effort to meet increased job demands, insecurity about the future and combining (shift) work with private life, a pilot's mental and physical capacities are likely to become depleted, which results in exhaustion. Having to expend effort to meet the increased job demands also decreases effort towards engaging in job crafting activities or strategies to adjust their work to their preferences. Thus, employees become mentally and physically exhausted as well as unwilling to engage in activities that could keep their level of functioning at high level.

Second, employees need to be motivated to perform safely as well as to have ways to replenish their mental and physical capacities. Increased job resources, such as developmental possibilities, and a supportive environment are likely to foster pilot growth and learning and allow them to achieve their goals. In addition, these job resources help pilots to offset the negative influences of demands in the workplace. Thus, pilots are motivated to function optimally at work and outside work because job resources will replenish their mental and physical capacities, whereas the absence of job resources will result in diminished functioning. In this unmotivated state, employees are less likely to initiate proactive, job crafting behaviours that would help them to excel, and consequently they diminish their willingness to perform well during the simulation training or to live a happy life. Therefore, our final hypotheses are:

> *Hypothesis 4*: Job demands will have an indirect negative effect on performance at simulator checks/training (4a) and happiness (4b) through exhaustion and job crafting.

> *Hypothesis 5*: Job resources will have an indirect positive effect on performance at simulator checks/training (5a) and happiness (5b) through disengagement and job crafting.

Method

Participants and procedure

Participating pilots were members of the European pilots' professional association. All active members of the professional association received an invitation to fill in an on-line questionnaire as part of a study of pilots' well-being. In order to fill in the questionnaire they had to login with their own membership code. The questionnaire was on-line for two months, in July–August, 2016. The survey was filled in by 1147 pilots, representing a response rate of 12.82%. Most respondents were male (91.4%) compared to female (8.6%) and their mean age was 46.8 years. 82.2% of the pilots were living with a partner, while of these pilots 59.5% also have children living at home. Pilots had been working for a single employer for a relatively long time (average of 15 years), which is common in the aviation industry because

promotions are often based on seniority. Almost all pilots are directly employed (97.3%) and have long-term contracts, while a small amount (1.9%) was indirectly employed. Within the pilot sample, 59.4% works as a Captain, 39.1% works as a First Officer and 1.5% works as a Second Officer. As the total population of the pilots' union members consisted of 6.2% females, was on average 43.8 years old (SD = 12.9 years) and had 44% Captains and 30.5% First Officers, our sample consisted of significantly more females [χ^2(1 df)= 10.27 p < .01], older employees (t-test = 7.45, p <.001), Captains [χ^2(1 df)= 101.91 p < .001] and First Officers [χ^2(1 df)= 36.71 p < .001] than the total population.

Measures

Except for burnout and happiness, all scales were slightly modified either by eliminating items that were not relevant for the pilots' work or by modifying formulations such that they become applicable to pilots' work. The items are included in the Appendix.

Work to Private Life conflict was measured by two questions from Geurts et al. (2005). An example question is: 'How often does it happen to you that you have to cancel appointments with your spouse/family/friends due to work-related commitments?' Answers ranged from never (1) to all of the time (5).

Future insecurity was measured by five items. An example item is: 'I feel confident about my future employment terms and conditions'. The first two items (provided in the Appendix) were based on the scale of De Witte (2000) and the rest was developed for the purpose of this study. Answers ranged from strongly disagree (1) to strongly agree (4).

Social support was assessed with a three-item scale developed by Bakker et al. (2003), including: 'Can you count on your colleagues, if difficulties arise in your work?' Answers could range from never (1) to all the time (5).

Relationships with the organisation was measured with four items. An example item is: 'I believe my company recognises when I do a good job'. These items are based on the LMX questionnaire by Graen and Uhl-Bien (1995). Although the LMX questionnaire measures the exchange relationship with the leader, we asked participants to report their exchange relationship with their organisation as it is often the case that pilots don't really know who their leader is. Participants could respond on a four-point scale ranging from strongly disagree (1) to strongly agree (4).

Developmental possibilities were assessed with four items of a scale constructed by Van Veldhoven and Meijman (1994). An example item is 'My company offers me the opportunity to learn new things'. The response categories for all job resources ranged between strongly disagree (1) to strongly agree (4).

Burnout was assessed with the OLBI (Demerouti, Mostert, and Bakker 2010; Demerouti et al. 2003). The OLBI has two dimensions: exhaustion and disengagement from work. Each subscale consists of eight items, four positively worded and four negatively worded. Example items are: Exhaustion (e.g. 'During my work, I often feel emotionally drained') and Disengagement (e.g. 'With time, one loses the internal relationship with one's work'). Each item had four response alternatives, ranging from 1 (totally disagree) to 4 (totally agree). The positive and negative exhaustion and disengagement items were presented in mixed order.

Job crafting consists of three dimensions. Seeking resources (4 items, 'I ask others for feedback on my job performance') and seeking challenges (1 item, 'I ask for more responsibilities') were measured by items developed by Petrou et al. (2012). Optimising demands were measured by two items developed by Demerouti and Peeters (2017). An example item is: 'I look for ways to increase efficiency at work'. Pilots could indicate how often they showed each behaviour during the past three months by using answers from never (1) to all the time (5). We could use the data of another study among 130 employees (Demerouti and Peeters 2017) to examine the relationship between the reduced scale of job crafting utilised in the present study and the original scale. The correlation between the utilised seeking resources scale and the total scale was $r = .90$, $p < .01$, whereas the correlation between the utilised optimising demands scale and the total scale was $r = .91$, $p < .01$. The correlation between the seeking challenges item and the total scale was $r = .40$, $p < .01$.

Happiness was measured with one question: Taking everything together, how happy do you feel with your life, from not happy at all (1) to very happy (10) (Schwarz et al. 1987). The validity of one-item measures for happiness has been justified by Lyubomirsky and Lepper (1999) and Abdel-Khalek (2006).

Performance at simulator checks/training. In order to collect an objective performance measure, we asked participants to report the *average score* he/she received at simulator checks/training, which takes place twice a year as a minimum. Answers ranged from below standard (1), meets standard (2) and above standard (3).

Results

Descriptives

Table 1 provides the means, SD and correlations of the study variables. Inspection of the scores on performance at simulator checks/training indicated that only one pilot got the score 'below standard. This participant was eliminated from the further analysis and the variable performance at simulator checks/training was treated as categorical-dichotomous. Of the remaining participants, 556 (48.6%) reported that they received 'standard' and 589 (51.4%) 'above standard' score. As there are no validated clinical scores for the OLBI, we used the data of Demerouti, Mostert, and Bakker (2010), who administered the MBI-GS and the OLBI to an English speaking population, to specify which score for each OLBI dimension corresponded to the very high score of the MBI-GS for working populations and the high scores for employees that are under treatment for burnout (clinical group) as specified by Schaufeli and van Dierendonck (2000). The cut-off scores for the OLBI were the following: exhaustion ≥2.85 and disengagement ≥2.6 for *very high* burnout of working employees (working sample) and exhaustion ≥3.13 and disengagement ≥2.72 for *high* burnout of employees under treatment of burnout (clinical sample). Using these cut-off scores, we found that 40.02% of participating pilots could be classified as having very high symptoms of burnout compared to the norms of working employees, whereas 20.31% could be classified as having high burnout compared to the norms of employees under treatment for burnout. In addition, 88% of the respondents regularly to (very) often see that colleagues (fellow pilots) are already fatigued when they start their working shift.

Longitudinal analysis

The model including all hypothesised relationships was tested with structural equation modelling analyses using the Mplus software package (Muthen and Muthén 1998–2006) because it easily accommodates both continuous and categorical variables simultaneously in the same analysis (Vandenberg 2006). We used weighted least square parameter estimates, which is appropriate when dependent variables are categorical (cf. performance at simulator checks/training). The proposed model includes two latent factors, namely job demands (indicated by work-self conflict and future insecurity) and job resources (indicated by social support by colleagues, relationship with the organisation, developmental possibilities) and seven observed variables: exhaustion, disengagement, job crafting dimensions (seeking resources, seeking challenges and optimising demands), happiness and performance at simulator checks/training. The model includes the following hypothesised paths: job demands → emotional exhaustion, job resources → disengagement, exhaustion/disengagement → job crafting dimensions → performance at simulator checks/training/happiness (see Figure 1). The model further includes the correlations between the latent factors (job demands and job resources) and burnout dimensions (exhaustion and disengagement). Finally, we controlled for organisational tenure by correlating it with job demands

Table 1. Means, standard deviations (SD), correlations and Cronbach's alpha (on the diagonal) of the study variables, $N = 1145$.

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12
1. Organisational Tenure	12.30	8.65	–											
2. Work-life conflict	3.21	.67	−.04	.39 a										
3. Future Insecurity	2.69	.49	−.06	.40**	.62									
4. Social Support	3.40	.76	−.12**	−.28**	−.32**	.79								
5. Relationship with Organ.	2.16	.61	−.11**	−.35**	−.43**	.42**	.82							
6. Developmental Possible.	2.28	.59	−.15**	−.29**	−.41**	.40**	.60**	.84						
7. Seeking Resources	3.16	.62	−.13**	−.09**	−.06	.34**	.24**	.32**	.67					
8. Seeking Challenges	2.31	.96	−.24**	−.07*	−.01	.18**	.18**	.20**	.44**	–				
9. Optimising Demands	3.49	.82	−.08*	−.02	.00	.17**	.13**	.13**	.39**	.29**	.60 a			
10. Exhaustion	2.86	.46	.03	.62**	.45**	−.36**	−.50**	−.40**	−.24**	−.20**	−.12**	.83		
11. Disengagement	2.61	.47	.00	.42**	.45**	−.38**	−.55**	−.56**	−.34**	−.20**	−.18**	.68**	.79	
12. Happiness	6.61	1.97	−.03	−.42**	−.44**	.30**	.34**	.32**	.13**	.06*	.05	−.49**	−.47**	–
13. Performance at simulator checks/ training b	2.51	.50	.18**	.02	.02	.06	−.06	−.09*	.04	.11**	.11**	.04	.03	.01

aRepresents inter-item correlation.
bRepresent polychoric correlations.
*Indicates $p < .05$ (2-tailed).;
**Indicates $p < .01$ level (2-tailed).

and resources and by including paths on all observed, endogenous variables.

The resulting significant paths are displayed in Figure 1 as solid lines. In line with Hypothesis 1a and 1b, we found that job demands were significantly related to exhaustion and job resources to disengagement (estimate = .81, SE = .03, $p < .001$; estimate = −.89, SE = .06, $p < .001$, respectively). In turn, exhaustion was significantly and negatively related to seeking challenges (estimate = −.20, SE = .09, $p < .05$), whereas disengagement was significantly and negatively related to all job crafting dimensions (seeking resources: estimate = −.44, SE = .05, $p < .001$; seeking challenges: estimate = −.28, SE = .08, $p < .001$; optimising demands; estimate = −.32, SE = .08, $p < .001$). These findings provide support for hypothesis 2b and 3. Hypothesis 2a and 2c had to be rejected as exhaustion was unrelated to seeking resources and optimising demands. Furthermore, from the job crafting dimensions, seeking challenges and optimising demands were positively related to the performance on simulation checks/training (estimate = .27, SE = .07, $p < .001$; estimate = .19, SE = .08, $p < .05$, respectively). Results further indicated that although none of the job crafting dimensions were related to happiness, both burnout dimensions were negatively related to happiness (exhaustion: estimate = −1.33, SE = .15, $p < .001$; disengagement: estimate = −1.14, SE = .15, $p < .001$, respectively). The control variable, organisational tenure, was negatively correlated with job resources, positively related to exhaustion and performance at simulator checks/training and negatively related to disengagement and job crafting.

As Mplus does not provide fit indices for this analysis except for AIC (and BIC), we compared the AIC of alternative models after controlling for the number of parameters and the number of participants (Willias and Moral-Benito 2016). The hypothesised model was compared to a model in which job demands and resources were directly related to happiness and the performance at simulation training. This model did not result in a lower AIC than the proposed model and the path from job resources to happiness was negative rather than positive (given the positive correlations of the separate job resources with happiness). Similarly, adding direct paths from job demands and resources on the job crafting dimensions did not result in a better model. Finally, adding the path happiness → performance on simulator training did not result in a better model (AIC = 33053.41, BIC = 33335.83) and the additional path was not significant (estimate = .003, SE = .031, $p = .92$).

Mplus calculates the significance of the indirect effects using the bootstrapping method (Stride et al. 2015). Results indicated that the indirect effect of job demands on the performance on simulation checks/training through exhaustion and seeking challenges was significant and negative (estimate = −.044, SE = .022, $p < .05$). This is the drop in the probability to get above standard in the simulator checks/training due to the indirect effect of job demands. Similarly, the indirect effect of job resources on the performance on simulation training via disengagement and seeking challenges as well as disengagement and optimising demands was significant and positive (estimate = .066, SE = .028, $p < .05$; estimate = .056, SE = .027, $p < .05$). This is the increase in the probability to get above standard in the simulator checks/training due to the indirect effect of job resources. Moreover, job demands had a significant, indirect and negative relationship with happiness through exhaustion (estimate = −1.076, SE = .127, $p < .001$) and job resources had a significant, indirect and positive relationship with happiness through disengagement (estimate = 1.019, SE = .148, $p < .001$). These findings provide partial support for hypothesis 4 and 5 as the negative indirect effects of job demands (through exhaustion) and the positive indirect effects of job resources (through disengagement) on performance at simulator checks/
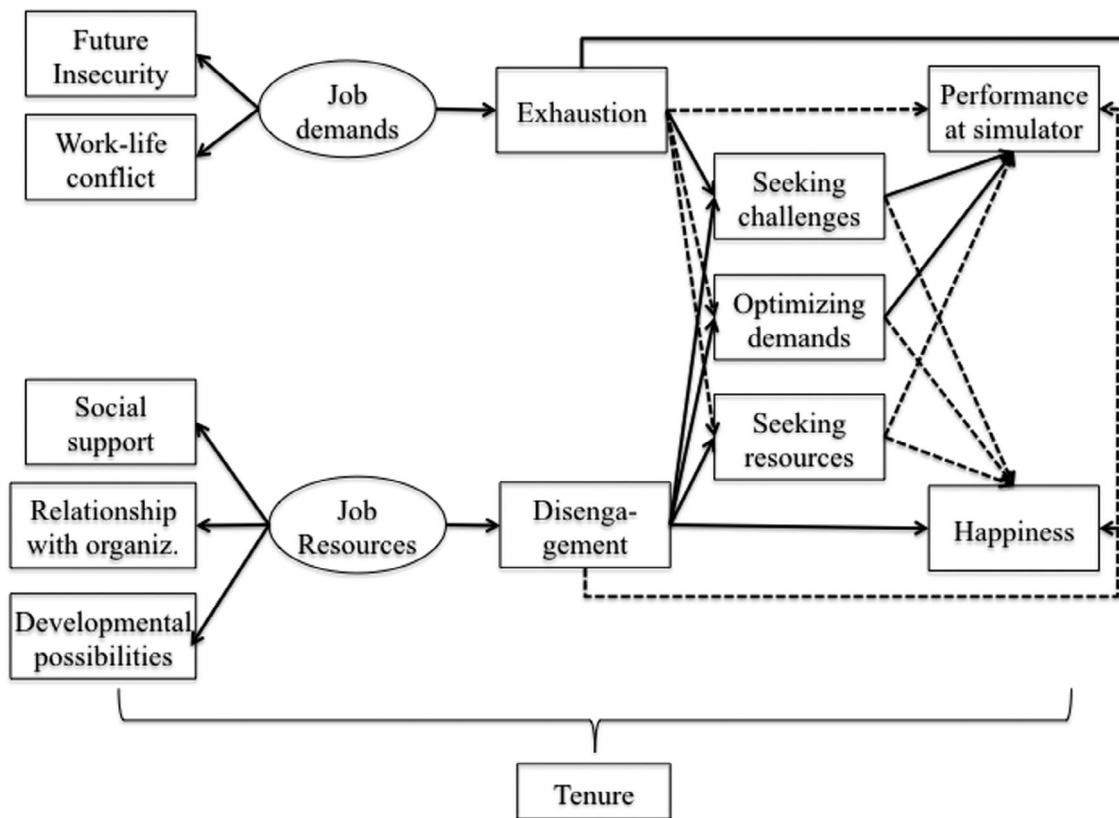
Figure 1. The hypothesised job demands-resources model of burnout among pilots.
Notes: Paths with dotted lines were not significant. Correlations between tenure and exogenous variables as well as paths from tenure to endogenous variables are excluded for simplicity.

training were confirmed only for the seeking challenges dimension of job crafting. Job demands were negatively and job resources were positively related to happiness through burnout.

Discussion

This is the first study among airline pilots that focused on burnout and aimed to uncover the psychosocial work characteristics that relate to the experience of burnout as well as its outcomes. Using a large sample of airline pilots employed at a range of airline companies from low-cost carriers to traditional flag carriers and operating different types of flights, we showed that 40% of the pilots who participated in our study experience very high burnout compared to the norms of working populations, whereas 20% could be classified as having high burnout compared to populations under treatment for burnout (Schaufeli and van Dierendonck 2000). In line with the predictions of the Job Demands-Resources theory (JD-R; Demerouti et al. 2001), we found that burnout was related to the perceptions of job demands and job resources, which highlights the importance of psychosocial work characteristics for the experience of burnout among pilots. Burnout is not

only important in its own right as it indicates diminished occupational health. We found that pilots' burnout was related to two important outcomes: happiness and simulator training performance. The higher the level of burnout the less happy the pilots were with their life, which highlights the tremendous implications of burnout for the life of pilots. Burnout was not only related to diminished happiness or well-being but also to an observable, more objective outcome which is relevant for pilots: performance at the simulator training. Results, however, failed to confirm the direct negative effect of burnout on simulation training performance. Rather, our results suggest that burnout diminishes performance at simulator checks/training because pilots lack the (energy) resources to adjust (craft) their work characteristics such that they fit their preferences and enhance their optimal functioning. These findings have important theoretical and practical implications.

First, our study showed the relevance of burnout for pilots. In a study among more than 13,000 employees from several occupations, Bakker, Schaufeli, and Van Dierendonck (2000) found that 4% had burnout, i.e. very high score on two of the three MBI-GS dimensions. Although Bakker et al. found that some occupations had

a higher risk to burnout e.g. health care professionals with 11–14% burnout, in none of the occupations that participated in that study was the percentage of burnout higher than 14%. These percentages are substantially lower than percentages of burnout among pilots as Fanjoy, Harriman, and DeMik (2010) found 32% and we found 40% of the pilots had very high burnout symptoms (according to norm scores of working populations) or 20% had high burnout symptoms (according to norm scores of a clinical group). Interestingly, pilots did not experience only high levels of exhaustion, which is maybe inherent of the nature of the pilots' job (shiftwork, long working days, unfavourable environmental conditions, etc.), but also high levels of disengagement. Disengagement is motivational in nature and as such is less dependent on demanding aspects (but rather more on motivational aspects) of the job. This means that four of the ten pilots are burnt out and still work while having diminished health, whereas one of the five pilots could urgently use some kind of intervention or treatment. The question this raises is whether burnout is inherent in the job of a pilot (and thus unavoidable that a pilot will experience it) or whether it is not the job per se but that often the conditions that pilots work in are suboptimal.

Our second contribution is that we showed the psychosocial work characteristics that are related to the experience of burnout. Fanjoy, Harriman, and DeMik's (2010) study indicated that shortened rest periods, adverse weather, aircraft maintenance issues and pressures to meet on time performance goals are potential contributors to pilot burnout and resulting safety concerns. While these are very important contextual conditions that airline companies urgently need to address, our study showed that it is not only these rather objective demands that influence occupational health of pilots. We showed that the degree to which work interferes with private life and insecurity about future employment is related to high feelings of exhaustion. Moreover, pilots that experience their colleagues as not supportive and perceive their airlines as not offering opportunities for development or that have a low-quality relationship with the pilots/employees distance themselves from their work psychologically. These results are in line with earlier studies (e.g. Bakker, Demerouti, and Sanz-Vergel 2014) and highlight the conclusion that, even for pilots, burnout is the outcome of a health impairment process and a motivational process that are triggered by overly high or unfavourably designed job demands and insufficient job resources. The question is, however, whether the experience of burnout translates itself into further consequences with negative implications for the pilots, airlines or the safety of the passengers and the environment.

Our third contribution is that we uncovered whether burnout is related to well-being and behavioural outcomes.

Similar to earlier research (Demerouti et al. 2000), burnout was negatively related to happiness with life. This means that burnout experiences generalise outside work and influence the overall life of pilots and most probably also the life of their families (through crossover processes; Bakker 2009). The tragedy of Germanwings showed that mental health and well-being have important implications on the behaviour of pilots and thus it is important for airlines to regularly assess such indicators and to intervene when these deteriorate (BEA 2016). Unexpectedly, we found that job demands and resources were respectively negatively and positively related to happiness only through burnout and not through job crafting. However, earlier research has also shown that proactive behaviours and positive affect are not positively related (Lam, Spreitzer, and Fritz 2014) and happiness represents a state of mild activation (Oerlemans, Bakker, and Veenhoven 2011).

Next to happiness, we expected that burnout would be directly related to performance at simulator checks/training. However, results failed to confirm such a relationship. Earlier research has also shown that burnout has rather low and inconsistent relationships with more objective performance indicators probably because individuals do everything they can to keep their performance at acceptable levels (at the cost of their own health) (Demerouti and Cropanzano 2010). However, what we did find is that the higher the burnout the less inclined pilots are to use strategies at work that could help them to improve their work characteristics, i.e. job crafting. Of the job crafting strategies, seeking challenges and optimising demands were found to be used more often by pilots that scored above standard on the simulation checks/training. Moreover, whereas exhaustion was related to pilots being less inclined to search for more challenges in their work, disengagement was related to fewer attempts to seek challenges and to optimise demands. Although job crafting can take the form of expanding the pool of resources, this strategy was not related to performance on the simulation checks/training. This finding agrees also with earlier research, which showed that seeking resources is effective for work engagement and indirectly for performance outcomes (Demerouti, Bakker, and Gevers 2015) and indicates that performance outcomes profit from proactive strategies directed towards maximising or optimising demands or challenges.

The health impairment and the motivational process were confirmed among pilots. In line with the JD-R theory, job demands were detrimental for performance at simulation checks/training because they made pilots more exhausted and less willing to craft their job, whereas job resources had a favourable effect on performance at simulation checks/training because they reduced feelings of disengagement and increased job crafting attempts.

This implies that the job of a pilot is not only detrimental for health-related outcomes, i.e. exhaustion (because of high or badly designed job demands) but also for motivation due to lack of job resources. Our study not only confirmed the JD-R theory among pilots but also showed why burnout is related to work outcomes. Namely, burnout is related to deteriorating attempts of individuals to adjust their environment to fit their preferences, which eventually translates into worse performances. Pilots' performance seemed to profit from attempts to make their work more challenging and to 'work smarter'. Challenging work helps people to experience flow in activities (Csikszentmihalyi and Nakamura 1989).

Limitations

The application of a cross-sectional design to examine presumed causal relationships between the variables represents the first limitation of this study. For example, one may argue that better performance, higher burnout or the use of more successful job crafting strategies can also be an antecedent of the perception of job demands and resources, since employees who perform well may experience a positive spiral in which they feel more efficacious and supported by their organisation (Salanova et al. 2010). We chose the specific order based on theoretical arguments and earlier research findings. However, the present findings are tentative until replicated in studies with longitudinal designs.

In a related vein the data are self-reports and therefore could be subject to common method biases, which threaten the robustness of our findings and precludes causal inferences (Podsakoff et al. 2003). Consequently, the true associations between the constructs might be weaker than the relationships observed in the study. However, since the findings are similar to theory-rooted hypotheses, and because the bivariate correlations are not that high, common method variance should not be a serious threat to the findings. The study was strengthened by the incorporation of information from the score that pilots received at the last simulation checks/training.

Although our measure of performance at simulation checks/training is more objective indicator of pilots' performance it also has several limitations. First, the simulation checks/training happened before the pilots completed the on-line questionnaire (as they completed their previous score, which may be at most half a year old). This means that the outcome might have occurred before the hypothetical predictors. Generally, this would mean the threat of causality. In our study, however, we think that this is not a serious problem as the constructs that we measure are generally stable with exception of job crafting, which may fluctuate daily. To overcome this problem, it would be advisable to have pilots completing the questionnaire prior to the simulation checks/training. Second, although we emphasised the anonymity it is possible that the pilots reported a higher score than what they actually received in order to present more positive picture of themselves. Therefore, the findings regarding the performance at simulation checks/training should be interpreted with caution.

Due to the nature of the pilots' work several of the items that we used had to be modified or dropped. This resulted in some scales consisting of only two items or in scales with reliabilities lower than the conventional criterion of .70. Moreover, two constructs, i.e. happiness and seeking challenges were measured with one item each. Although one-item measures for happiness are accepted in the literature, since they correlate highly with full scales and show high temporal stability (Abdel-Khalek 2006), the issue is that measurement error of one-item measures is unknown. The high correlations of the utilised, short scales with the total scales indicate that the measures that we used capture the essence of the original job crafting scale. Still, it is important that future researchers develop reliable scales that are appropriate to measure psychosocial aspects of pilots.

Although we were successful in collecting data from a large number of pilots, our sample differs significantly from the population in several respects (gender, age, function level). This means that generalisation of the findings to the total population should be done with caution as older captains may experience their work differently than younger first officers. Future studies should strive for more representative samples of the pilots' population.

Practical implications

Nowadays, airliners operate in a highly competitive environment where cost control is a main priority. For future developments, it should be taken into account that intensifying working conditions top-down increases job demands and this harms pilots' well-being when it is not accompanied by gain in job resources. In order to improve pilots' well-being, the airlines could focus on three possible interventions. First, it is important to support the pilots that are experiencing high levels of burnout. These pilots need to be recognised/diagnosed and offered the possibility to discuss with their supervisor and company doctor whether adjustments in their job can be made and how their symptoms of burnout could be reduced with treatment. It is important to mitigate potential negative consequences of reporting burnout symptoms to reduce barriers for self-declaration. A prospect of losing the right

to fly may create an increase in future demands, preventing pilots from reporting burnout symptoms. Furthermore, to prevent development of burnout symptoms, airlines should lower barriers for pilots to report 'unfit to fly'.

Second, as pilots report high job demands it is important to consider redesigning the amount of work and the working times since these demands influence feelings of exhaustion and consequently performance. In particular, the high levels of work to private life conflict and future insecurity are of main concern. To reduce these demands, the shift plans of pilots should be optimised such that recovery is facilitated. Moreover, pilots should have more possibilities to influence their roster and adjust it to their private lives or requesting days off-duty should be made easier. Company communication and information in mass media could be used to promote the experience of future security among pilots.

Third, pilots should be provided access to job resources such as opportunities to develop themselves (e.g. by offering them the opportunity to learn new things) and support by the organisation, as job resources not only make them less disengaged in their job but they also buffer the negative impact of job demands on well-being and help them to perform better. Development opportunities can, for example, be increased by giving pilots leadership or cooperation training or giving them the possibility to extend their work by performing ancillary working activities (thereby reducing fatigue as well). Organisational support can be stimulated by making it easy to approach a supervisor when difficulties arise. Next to pilots, the organisation should itself take initiative as well to support their pilots by spending time to give individual feedback or appreciation.

Pilots can themselves alter their job conditions in a bottom-up manner. By actively seeking extra challenges or by finding ways to work smarter they can stimulate their well-being. These individual strategies should be supported by the supervisor and the organisation as they can complement top-down approaches to improve well-being. Employee well-being is an important organisational asset since it is related to employee performance, safety behaviour and whether employees are prepared to go the extra mile and it should therefore derive extra attention from airline organisations.

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Appendix

Work to private life conflict

How often does it happen to you that …

(1) you have to cancel appointments with your spouse/family/friends due to work-related commitments.
(2) you don't fully enjoy your work because you worry about domestic obligations.

Future insecurity

(1) I feel confident about my future employment terms and conditions.
(2) I believe the future of my company looks bright.

(3) I am concerned about losing my medical licence.
(4) I currently worry about meeting financial obligations.
(5) I feel confident my pensions provisions will be adequate for my retirement.

Social support

(1) If necessary, can you ask your colleagues for help?
(2) Can you count on your colleagues to support you, if difficulties arise in your work?
(3) In your work, do you feel valued by your colleagues?

Relationships with the organisation

(1) I believe my company recognises when I do a good job.
(2) I feel valued by my company.
(3) My company is sympathetic towards any problems I may have at home.
(4) My company helps me to solve any problems I may have at work.

Developmental possibilities

(1) In my company, I have the opportunity to develop my strong points.
(2) My company offers me the possibility to learn new things.
(3) My job as a pilot offers me the opportunity to be innovative.
(4) In my company, I feel that career progression is possible and encouraged.

Job crafting

(1) I ask others for feedback on my job performance. (Seeking Resources)
(2) I ask colleagues for advice. (Seeking Resources)
(3) I try to learn new things at work. (Seeking Resources)
(4) I contact other people from work (e.g. fellow pilots, flight operations manager) to get the necessary information for completing my tasks. (Seeking Resources)
(5) I ask for more responsibilities. (Seeking Challenges)
(6) I think of solutions in order to carry out my work more easily. (Optimising Demands)
(7) I look for ways to increase efficiency at work. (Optimising Demands)