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**ORIGINAL ARTICLE**

# Navigating the Activity-Based Working Environment – Relationships of Self-Leadership, Autonomy and Information Richness with Cognitive Stress and Performance

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In activity-based working environment (ABWE) offices, employees are allowed increased autonomy and are expected to choose where, when, with whom, and to some degree with what, to work; in other words, employees are expected to self-lead to a higher degree and to coordinate and align with colleagues. Effects of these expectations on employees' cognitive stress and performance are understudied. In the present study, Swedish ABWE workers ($N$ = 416) are compared with workers in cell offices ($N$ = 30) and landscape offices ($N$ = 64), and relationships of self-leadership, information richness, and autonomy with cognitive stress and performance were examined using regression analysis. Results show no relationship between office type and outcomes. For cognitive stress, information richness had the largest negative relationship, followed by self-leadership: goal-setting and autonomy. For performance, self-leadership: goal-setting had the largest positive relationship, followed by information richness. This suggests that when organizational situations cannot be strongly structured – for example because the best work process is not known, or innovation or different collaboration constellations are needed – they need instead to be *enriched* so that employee orientation and coordination do not become too much of a burden on the individual employee, disrupting cognitive functioning and performance.

**Keywords:** activity-based working environment; flex office; self-leadership; information richness; performance; cognitive stress

## Introduction

Over the past decades, office work has become more cognitively taxing (Wegman et al., 2018). Increased complexity (Hanson, 2004: 11), intensity (Allvin et al., 2006: 149–150), and expectations of collaboration (Deming, 2017), not least through information and communications technology (ICT) (Mazmanian, Orlikowski and Yates, 2013), place higher demands on workers' executive functions, such as memory and direction of attention (Stenfors et al., 2013; van Knippenberg et al., 2015). On almost all fronts, limitations around work seem to have become less explicit in terms of *what* the actual task is, as well as *when*, *where*, *how*, and *with whom* to perform it (Allvin et al., 2013: 105; Grant, Fried and Juillerat, 2010: 436). When employees face relatively 'weaker' situations (Mischel, 1977) – unclear job or role prescriptions, vague task descriptions, uncertain divisions of responsibility – employee autonomy is more valuable and relates to better performance (Cordery et al., 2010). Accordingly, skills related to leading and regulating oneself have become increasingly important (Neck and Houghton, 2006; Seibert, Kraimer and Crant, 2001; Thomas, Whitman and Viswesvaran, 2010). Deregulation of where and when to work, extensive use of digital, mobile tools, and new and flexible use of office facilities are core concepts in activity-based working environment (ABWE), currently a trend in Sweden, Holland, and Australia.

In ABWE, employees are allowed increased autonomy and are expected to choose where, when, with whom, and to some degree with what, to work (van Koetsveld and Kamperman, 2011: 305). In other words, workers are expected to *self-lead* to a higher degree, on an individual level, and self-organize on a collective level, i.e. coordinate and align their actions on a peer-to-peer basis. However, it is not clear what the possible effects of such expectations may be in terms of individuals' cognitive stress and

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performance in the ABWE setting. In a recent review of ABWE research, Wohlers and Hertel (2017) found only five empirical papers examining the impact of ABWE on work-related outcomes such as employees' (cognitive) health, motivation, and productivity. We propose that if one does not pay attention to the individual's ability, either by drawing on personal or job resources, to make decisions and to find their way in a deregulated working environment – essentially, their ease of navigating the ABWE – one will be missing central aspects bearing on employee health and performance in the ABWE setting.

Studies on employee discretionary behaviors show they are more valuable for performance under conditions of ambiguity (Cordery et al., 2010) – or what one might call under-organized (Weick, 1985), under-designed (Hatchuel, 2002), or 'weakly structured' (Papavassiliou and Mentzas, 2003) work – the common characteristic being that action in the organization is less externally regulated (Judge and Zapata, 2015), like in ABWE. Where leaders take a step back or otherwise are less visible and present with workers, such as is often the case in ABWE (Parker, 2016: 192), self-leadership can substitute leadership (Manz and Sims, 1980). However, as individuals are expected to take on more decisions about their workday and coordinate amongst themselves, the importance of situational judgment increases. But as traditional external cues of appropriate behaviors are diminished, individual standards and social relations must 'fill the gap' for employees to navigate their work (Allvin et al., 2006: 150–155). That the employee nevertheless has timely access to work-relevant cues, about what and how they should be working, likely lessens the cognitive load on individuals and improves performance; in this study, we call this timely access 'information richness', inspired by Weick (2001: 10) and Daft and Lengel (1986). Studies of virtual teamwork compared to face-to-face teamwork show that effective information sharing, coordination, problem solving, building trust, and resolving conflicts become more difficult with virtuality (Hill and Bartol, 2016). Communication demands increase dramatically and media richness becomes critical (e.g. face-to-face communication provides more social cues than e-mail communication) for complex but not for simple tasks (Hollingshead, McGrath and O'Connor, 1993: 25). That is, simple tasks do not suffer from being handled virtually, while complex tasks do. In ABWE, workers are less predictably and reliably at any one place at any one time and thus, how they are targeted with information is less clear. As workers and their managers are not co-located by default, more effort may have to go into achieving sufficient richness of information, highlighting information richness as a vital job resource.

We know little of the relative weight of personal and job resources in the context of ABWE, where employees' self-organization is both expected and possible (van Koetsveld and Kamperman, 2011: 307), i.e. not only should employees lead themselves, they should interact and coordinate their actions, in a way aligned with organizational goals, without (much) instruction from management. Considering the centrality of employees' self-organization to the concept of ABWE, it is surprising that employee self-leadership and coordinating mechanisms have not previously been more extensively studied in this context. And though implementing ABWE is an ongoing trend, relatively few studies have empirically examined effects on employees' health, satisfaction, motivation, and productivity. Of the empirical studies that exist, effects on employees appear contradictory, with findings in both positive and negative directions (Wohlers and Hertel, 2017). The present study contributes to these larger issues by examining resources vital for employees' capacity for self-organization – autonomy, self-leadership, and information richness – and their relationships with employees' cognitive functioning and performance in ABWE.

A theoretical underpinning of this research is the Job Demands-Resources theory (JD-R theory; Bakker and Demerouti, 2007). The JD-R model of work gives an overarching framework where the various factors affecting a particular situation at work are categorized as either *demands* or *resources*; while leaving flexibility in determining which particular demands, and which particular resources, are especially salient and relevant in particular kinds of work (Demerouti et al., 2001). Considering the empirical context of ABWE and its simultaneous goals of collaboration, employee discretion, and autonomy, we consider especially relevant resources facilitating orientation, sensemaking, and management of one's own activities.

In a wider context, this study also relies on a systems approach to work and organizing in which organizational outcomes, such as innovation and effectiveness motivating the implementation of ABWE, emerge from generative *micro-systems*: interactions between individuals and between individuals and organizational structure (Lichtenstein, 2014: 53–55; Uhl-Bien, Marion and McKelvey, 2007; Werr and Runsten, 2016: 25–27). In such a view, what ultimately becomes organizational outcomes is highly dependent on individuals' understanding of what to pay attention to and how they make sense of their responsibilities (Runsten, 2017; Weick, 2001: 26), further highlighting information richness, autonomy, and self-leadership as resources of particular interest to handle cognitive stress and perform well.

This paper contributes to knowledge of self-leadership in a new work setting (ABWE), and to knowledge of individual consequences of modern working life by demonstrating that job resources, not just personal resources, are still very important for managing stress and performance even when the individual herself is expected to decide where, when, how, and with whom to work.

The name activity-based workplace originates from the Dutch consultancy Veldhoen Company, in the mid-1990s (Parker, 2016). An ABW office is characterized by free seating (i.e. no fixed workstation), clean desk policy, and different zones created for different activities. There can be a quiet zone meant for work that demands focus and concentration or more social zones where one can work together and overhear others' conversations. Further, there are meeting rooms of different sizes and

with differing equipment, as well as 'phone booths'. The philosophy of the activity-based workplace is to make work 'effective, efficient and enjoyable' from both an organization and employee perspective (van Koetsveld and Kamperman, 2011). This vision is to be achieved by focusing on the employee and giving them 'the freedom (within boundaries) to decide how to work, where to work, when to work, the tools to use and with whom to collaborate to get their work done' (van Koetsveld and Kamperman, 2011: 305). The management practices should be based on trust, autonomy, and self-organization for employees (van Koetsveld and Kamperman, 2011: 305). Thus, freedom and loose boundaries are part and parcel of the vision and concept of ABWE. Such deregulation of several dimensions of work could be described as more *boundaryless* (Allvin et al., 2013) than conventional office working, and to manage these choices, employees likely have to *self-lead* to a higher degree.

## Theoretical Background and Hypotheses Development

Cognitive complaints such as problems with memory, decision making, and concentration have mainly been studied in clinical populations such as the elderly and people with attention deficit hyperactivity disorder (ADHD) or depression. However, it is also of interest in the general working population. Modern office work may place a high load on executive functioning, due to complexities in the work, multiple channels and modes of communication (face-to-face, email, phone, instant messaging) and information (van Knippenberg et al., 2015: 1), ICT demands in particular (Stenfors et al., 2013) and a sense of boundarylessness (Albertsen et al., 2009). An ABWE relies on workers making up their minds about what to work on, *where* to best perform this work, *with whom* (if anyone) to work on a task and finding and coordinating with that person, as well as keeping a clean desk, i.e. favoring digitized tools and information over physical artefacts. Each of these components is taxing a worker's executive functions, their attention, and self-regulation. Having lower levels of executive functioning may, therefore, be especially noticeable to working individuals (Stenfors et al., 2013). While simpler cognitive tasks can be performed with much automaticity and do not tax the executive functions, more complex cognitive tasks require more controlled processes, such as choosing to invest effort, how to construe the problem and determining how to proceed, and thus involve the executive functions more (Schmeichel, Vohs and Baumeister, 2003). The use of executive functions in shifting and maintenance of attention, updating and manipulation of information in working memory – all crucial to the performance of knowledge work – is particularly vulnerable to both chronic and acute stress (Stenfors et al., 2013). Studies have shown that high self-reported cognitive stress correlates with poorer actual executive functioning (Stenfors et al., 2013).

The case has been made for ABWE as a means to increase collaboration and innovation in modern knowledge work (Appel-Meulenbroek, Groenen and Janssen, 2011; Parker, 2016). ABWE entails a flexible use of facilities, an increased use of communication systems such as email, chat, Skype, and video conferencing, decreased use of paper or other embodied as opposed to virtual resources, as well as the hope that employees will collaborate more and in different constellations, move around more, and thereby be more open to serendipitous meetings or ideas (Appel-Meulenbroek et al., 2011). At the same time, most of these factors could possibly have negative effects on productivity if they, for example, cause distraction or anxiety. Constant availability through mobile devices seem to increase strain and decrease 'time to think' (Mazmanian et al., 2013), and communication overload (e.g. through email) has been shown to affect knowledge worker productivity negatively (Karr-Wisniewski and Lu, 2010) and be associated with more cognitive complaints (Stenfors et al., 2013). Hot desking (that is, not having your own desk but moving around between or during days), a central practice in ABWE, can feel like a lack of structure and orienting reference points (Manca et al., 2018). Being distracted by talking colleagues has negative effects on productivity in open-plan offices (Seddigh et al., 2014). In what the ABWE seeks to increase, then, there lies a *risk* of cognitive overload likely to affect the productivity of knowledge workers. However, the ABWE does not seek to force people into open plan spaces for all activities, but rather, to allow employees the autonomy to make appropriate *choices* of environments to support them in the activity they are currently undertaking. The choice of environment also relates to personal preference (Appel-Meulenbroek et al., 2011).

In a JD-R perspective, ABWE could be said to provide employees with additional job resources to meet demands: a variety of environments to support different modes of working, and technologically enabled lines of communication that 'open up' all people in the organization and thus encouraging seeking information and support more widely in the organization (Parker, 2016: 188). Empirical work relating office type and employee outcomes suggests flex offices (ABWE) and cell offices relate to greater health and job satisfaction (Danielsson and Bodin, 2008), that ABWE contributes to greater vitality and better job attitudes (Wohlers, Hartner-Tiefenthaler and Hertel, 2017), and that people in ABWE were more satisfied with the physical environment but less satisfied with productivity support and concentration (De Been and Beijer, 2014).

However, it is possible that ABWE, by contributing to a 'weaker' working situation, placing higher demands on employees' self-direction, information seeking, and boundary setting, is bringing with it additional *demands* on employees, not least on their cognitive functioning. Studies show that boundaryless and free work also contain threats of intensification and diffusion of work – and as a consequence, overload and burnout (Kelliher and Anderson, 2010; Schabracq and Cooper, 2000; Zika-Viktorsson, Sundström and Engwall, 2006). Based on

previous findings then we propose, somewhat tentatively, the following hypotheses:

*Hypothesis 1:* Working in ABWE will relate to lower cognitive stress.
*Hypothesis 2:* Working in ABWE will relate to higher performance.

***Autonomy*** – Autonomy affords workers control over their workday and performance of tasks and is considered a central job resource for employee health, as it is associated with greater variety of opportunities for coping with stressful situations (Bakker, Demerouti and Euwema, 2005; Karasek, 1998) and satisfies intrinsic needs for control over one's own life (Ryan and Deci, 2000). Indeed, whether expressed as 'control', 'discretion' or 'autonomy', it is arguably one of the most extensively researched aspects of working life (Jones and Fletcher, 2003) and a key component of several theories of stress (e.g. Karasek, 1979; Payne and Fletcher, 1983; Warr, 1987).

Autonomy may also be considered a kind of 'catalyst' resource: a resource activating other resources, as it allows a worker increased opportunity to bring in any and all other resources at her disposal or to make use of resources in novel ways. For example, autonomy might inspire crafting further resources, or one's work role to achieve a better fit and thus reduce strain (Leana, Appelbaum and Shevchuk, 2009). Autonomy has also been shown to impact cognitive stress specifically (Albertsen et al., 2009). Thus, we propose:

*Hypothesis 3:* Autonomy will relate to decreased symptoms of cognitive stress.

***Self-leadership*** – In ABWE, managers have less control over workers simply by virtue of their autonomy over where to work. Workers are also expected to take on more responsibilities for managing their own work as well as coordinating with others (van Koetsveld and Kamperman, 2011: 305). *Self-leadership* (Manz, 1986) is a process of self-influence and a set of individual strategies that could be said to substitute the leadership behaviors otherwise offered by a manager (Kerr and Jermier, 1978). Strategies included in self-leadership are goal-setting, self-monitoring, self-reward, constructive thinking patterns, mental rehearsal, and focusing on intrinsically motivating aspects of work (Manz and Sims, 1980; Unsworth and Mason, 2012). Self-leadership is different from autonomy in that while autonomy describes a condition of work (having discretion over how and when to work, for example), self-leadership is a set of strategies for behavior and ways of thinking. Higher levels of self-leadership have been demonstrated to correlate with higher levels of individual performance (Hauschildt and Konradt, 2012; Prussia, Anderson and Manz, 1998), to some degree with team performance (see Stewart, Courtright and Manz, 2011, for a review), and also to protect against work strain (Unsworth and Mason, 2012) with heightened self-efficacy and positive affect as mediating mechanisms. Thought to increase personal resources contributing to internal motivation (Unsworth and Mason, 2012), self-leadership may help workers achieve their goals and keep a positive appraisal of their work, thus contributing to performance.

*Hypothesis 4:* Self-leadership will relate to decreased symptoms of cognitive stress.
*Hypothesis 5:* Self-leadership will relate to higher performance.

***Information richness*** – Job-based resources are physical, social, psychological and/or organizational aspects of the job, that are functional in achieving work goals, reduce job demands, and stimulate personal growth and development (Demerouti et al., 2001). In the ABWE, we hypothesize that *timely access to work-relevant information* is a crucial job resource for two reasons. Traditionally, the main coordination mechanism in organizations has been the bureaucracy (Adler, 2012). As workers have the freedom to decide when, where, and with whom to work, some level of *coordination* and *exchange of information* is crucial for work to flow efficiently (Uhl-Bien and Arena, 2017: 11), as well as to protect against stress by making employees feel in the know and up to date on priorities and deadlines and having access to others as they need. Information sharing has also been shown to be important for workgroup performance, as it supports task coordination (Mesmer-Magnus and DeChurch, 2009).

The necessary organizational coordination needs to happen at a microsystems level, which makes individuals' *understanding* of situations essential: 'we can argue that collective intelligence on the micro-system level is a process of coordination and as such will vary in quality in relation to factors such as the understanding of the situation (contextualizing, representation), the ability to learn, and the ability to act as a system (acting and coordinating)' (Runsten, 2017). What we call *information richness* – rich and timely access to work-relevant information – relates especially to this understanding of the situation, and the employees' abilities to make sense of information and of what it means for how they should work to provide value in their jobs, i.e. how they should coordinate themselves. Information flows are an important condition of enabling collaborative and adaptive organizational responses (Uhl-Bien and Arena, 2017: 11), a major motive for adopting ABWE practices in the first place. In accordance with Conservation of Resources (COR) theory, information richness will be valued both as a resource in itself, helping the workers orient themselves about what they should be doing and in getting their work done, and for illuminating other resources in the environment. It should, therefore, contribute to higher performance. An information-rich environment means the individual has to spend less – i.e. conserve – personal resources, not least *energy*, searching for information, interpreting ambiguous meaning, or re-inventing the wheel, likely protecting against cognitive stress. A key here is *relevant* work information. It is not a question of just 'more' information, which could as easily lead to information overload (O'Reilly, 1980; Weick, 2001: 10).

*Hypothesis 6:* Information richness will relate to lower symptoms of cognitive stress.

*Hypothesis 7:* Information richness will relate to higher performance.

## Method

### *Sample and setting*

Data for this study originates from a multi-disciplinary research project on activity-based workplaces, called *The Office of the Future*, financed by the Swedish governmental institute Vinnova. Three companies were partners in this research project, and also part of this study. One of these was a property development company developing ABWE offices, and through them access was granted to one other organization housed in their properties, giving a total of four participating organizations. Data were collected in 2015 from 1259 employees in the white collar sector, primarily based in Stockholm, but also Uppsala. In addition to property development, businesses were in software development and consulting. The questionnaire was sent by e-mail to all employees in the participating offices. During this time several reminders were sent. Final submission of survey answers was taken as consent to participate. Out of the 1259 answers, 1193 were valid (i.e. after excluding respondents who did not currently work in the organization due to change of jobs or a leave of absence). A total of 728 (61%) participants had responded to some of the items used in this particular paper. Out of these, 510 employees (43%), between ages 24–66, had responded to all relevant variables and became the final sample used in this paper. A dropout analysis revealed no differences between respondents and non-respondents except for age, where non-respondents were an average of 1.7 years younger ($p < 0.05$).

### *Measures*

**Cognitive stress.** Cognitive stress was measured using the cognitive stress scale, a four-item scale, from the Copenhagen Psychosocial Questionnaire (COPSOQ) (Kristensen et al., 2005). A sample item reads: 'In the past 3 months, how frequently have you had difficulties making decisions?' Items were scored on a 5-point scale, where 1 = Never (indicating no complaints) and 5 = Always. The $\alpha$ value of the scale in the study's sample was 0.88.

**Performance, self-rated.** Employees rated their own performance at work in the past month with one item: 'On a scale of 0 to 10, where 0 is the worst work performance anyone could do in your job, and 10 is a stellar performance, how would you rate your own general work performance in the days you have worked in the past four weeks?' The item was scored on an 11-point scale from 0 (worst) to 10 (best).

**Office Type.** The kind of office environment one was working in was determined on an individual employee basis. First respondents indicate whether they are working within an ABWE or not. For those not working in ABWE, a second question asked respondents to indicate whether they had a fixed working station, and if they did, where this working station was located, with options from a single cell office, a shared cell office, to a landscape office with options ranging from '4–9' to '25 or more' seats. In the analyses, these categorized into *ABWE*, *cell office* (one to three people), and *landscape*. Thereafter, two dummy variables were created, namely Cell Office (1 = Cell office; 0 = Other) and Landscape Office (1 = Landscape and 0 = Other), and thus ABWE was the reference variable (Cohen et al., 2003).

**Self-leadership.** Self-leadership was measured in a short form using six items from the Abbreviated Self-Leadership Questionnaire (ASLQ) (Houghton, Dawley and DiLiello, 2012), translated by the second author into Swedish. An exploratory factor analysis gave that all items did not load as one factor, and the scale was subsequently divided into *Goal-setting* ($\alpha = 0.92$) and *Thought strategies* ($\alpha = 0.77$). A sample item for goal-setting was: 'I establish specific goals for my own performance' and a sample item for thought strategies was: 'I visualize myself successfully performing a task before I do it''. Items were scored on a five-point scale from 1–5, where 1 = Do not at all agree and 5 = Agree completely.

**Information Richness.** To gauge how readily available work-relevant information is to the respondent at work, a scale with 13 items was created and of these, 5 were used in the final analysis. The items were 'The information I get in my workplace is reliable', 'I get information in time to do my work well', 'I can easily get the information I need in work-related issues', 'I feel like I find out about things at the last moment' (reversed) and 'I get enough information to perform my work to satisfaction'. Answers were given on a scale of 1–5 where 1 = Disagree completely and 5 = Agree completely. The $\alpha$ value of the scale in the study's sample was 0.86.

**Autonomy.** Employee control over their work, i.e. autonomy, was measured using two items based on the COPSOQ (Kristensen et al., 2005), 'I have the opportunity to control my working hours' and 'I have the opportunity to control where I work'. The $\alpha$ value of the scale in the study's sample was 0.69.

**Individual background characteristics.** As background variables, we included gender, age, and education level.

### *Statistical treatment*

We first ran a series of exploratory factor analyses, particularly because we had translated one scale into Swedish (Self-leadership) and had created our own scale for Information Richness. Results indicated that the Self-leadership measure did not cohere as one factor, but rather should be divided into two factors, the two-item factor of Self-leadership Goal-setting, and a four-item factor we call Self-leadership Thought Strategies. For Information Richness we decided to reduce the number of items from 13 to 5, based on the EFA. Thereafter, we ran CFA (confirmatory factor analysis) in R (R Core Team, 2016), using the lavaan package (Rosseel, 2012), to ensure that the proposed factor structure fitted the data well. We compared the proposed four-factor structure (M1) with a one-factor model (M2) (all items loading on one common factor), and a plausible alternative model, a three-factor model (M3) where all SL items load on one factor. Model comparisons were done with chi-square difference test

and the overall model fit was evaluated on the basis of chi-square, but also CFI (values above 0.90 are deemed to show good fit [Bentler, 1990]); TLI (for which values above 0.90 have been considered good fit, but where it has been considered to raise that limit to 0.95 [Hu and Bentler, 1999] and so the model performs weaker here), RMSEA (values at or under 0.08 are considered adequate fit [Steiger, 1990]) and SRMR (values under 0.08 indicate a good fit [Hu and Bentler, 1999])). As can be seen in **Table 1**, the four-factor model M1 was found to provide a significantly better fit to the data than any of the alternative models.

As a second step, descriptive statistics in terms of means, standard deviations, bivariate correlations, and alpha coefficients (where appropriate) were calculated for the research variables; see **Table 2** for an overview. Office type was used as the main grouping variable. Those working in ABWE are the biggest group, $N = 416$. To achieve an acceptable minimum group size, those in cell offices with 1–3 people in them were collapsed to one group ($N = 30$), and all those working in landscape offices of varying sizes (from 4 people and up), though not in ABWE, were grouped together ($N = 64$). In order to see whether different office types differed in background, predictor, and outcome variables, we furthermore performed Kruskal-Wallis's one-way analysis of variance for continuous variables, and Chi-Square ($\chi^2$) tests for categorical variables; see **Table 3**.

Third, in order to test our hypotheses, hierarchical regression analyses were run for each of the outcome variables: cognitive stress, and performance, respectively, in a stepwise procedure. In a first step, all background variables were accounted for. In a second step, office type was added in order to see how much additional variance the inclusion of office type explained in each of the outcome variables. In a final step, personal and job resources (self-leadership: goal-setting, self-leadership: thought strategies, information richness, and autonomy) were added to test how much the amount of explained variance in each outcome variable increased by adding these factors. In each step, regression coefficients were inspected to get a better understanding of how each of the added variables related to the outcome; see **Table 4**.

## Results

### *Descriptive results*

Means, standard deviations, bivariate correlations, and alpha coefficients for the research variables are presented in **Table 2**.

Of those participants not working in ABWE, i.e. they work in an ordinary cell office or landscape office, 90.4% had their own, determined working space while 9.6% did not. Of those not in ABWE who did have a determined working space, 22.3% have their own office, 12.9% share an office with one or two others, and the rest (64.8 %) work in some kind of landscape office plan.

Kruskal-Wallis's one-way analysis of variance was performed grouped on office type (and simple chi-square on categorical variables), comparing means on background, predictor, and outcome variables; see **Table 3**.

### *Hypotheses testing*

Results of the regression analyses are displayed in **Table 4**. For each outcome variable, background variables were entered in a first step. For cognitive stress, this proved significant and kept its significance throughout consecutive steps, showing that women had more cognitive stress and that age was a factor that protects against cognitive stress. For performance, only gender had an initial significant relationship, for women, but the variable was not significant in the last step.

As a second step, the office type dummy variables were entered, comparing cell office and landscape office to ABWE, testing for a relationship with cognitive stress and performance. No relationship was found between office type and cognitive stress. For performance, when office type was first added, the relationship was significant for cell office compared to ABWE – being in a cell office predicted somewhat lower performance than working in ABWE. The model adjusted $R^2$ was not significant, however, and as the resource variables were added, the significance of office type was lost, *giving no support to hypotheses 1 or 2.*

For the third and final step, autonomy, self-leadership goal-setting (SLGS), self-leadership thought strategies (SLTS), and information richness were added. Autonomy had a significant relationship with lower cognitive stress, *supporting hypothesis 3*. Due to the split of self-leadership into two separate factors, *hypothesis 4 was partially supported*: SLGS had a significant impact, while SLTS did not have any significant impact. For performance, *hypothesis 5 was similarly only partially supported*, as SLGS was the strongest predictor of performance while SLTS had no significant impact at all. Information richness was clearly the strongest predictor of (lower) cognitive stress, *supporting hypothesis 6*, and the second strongest predictor of performance, *supporting hypothesis 7*.

**Table 1:** Fit indices for measurement model and comparison models.

| Tested models | $\chi^2$(df) | CFI | TLI | RMSEA | SRMR | Model comparisons $\Delta\chi^2$(df) |
|---|---|---|---|---|---|---|
| M1: Measurement model[a] | 209.574 | .94 | .92 | .071 | .051 | – |
| M2: One factor | 1632.378 | .40 | .28 | .217 | .175 | *M2 vs M1:* 1422.8 (6)*** |
| M3: Three-factor model[b] | 683.065 | .76 | .70 | .140 | .082 | *M3 vs M1:* 473.49 (3)*** |

[a] Measurement model M1 includes the latent variables, i.e. the predictor variables Self-leadership: Goal-setting, Self-leadership: Thought Strategies, Information Richness, and Autonomy.

[b] Same as M1 but with all self-leadership items loading on one latent variable, i.e. a three-factor model.

*** $p < .001$.

**Table 2:** Bivariate correlations, means, standard deviations, and reliability coefficients. $N = 510$.

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | *M* | *SD* | *α* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Background | | | | | | | | | | | | | | | |
| 1 Gender (1 = m, 2 = f) | 1.00 | | | | | | | | | | | | 1.40 | .49 | – |
| 2 Age | –.09* | 1.00 | | | | | | | | | | | 42 | 9 | – |
| 3 University (1 = yes) | .06 | –.14** | 1.00 | | | | | | | | | | .70 | .46 | – |
| Office Type | | | | | | | | | | | | | | | |
| 4 Activity Based WE | .00 | .00 | –.04 | 1.00 | | | | | | | | | | | |
| 5 Cell Office | –.12** | –.14** | .00 | – | 1.00 | | | | | | | | | | – |
| 6 Landscape Office | .08 | .10* | .04 | – | – | 1.00 | | | | | | | | | – |
| Resources (1–5) | | | | | | | | | | | | | | | |
| 7 SL Goals | .01 | .05 | .07 | .19*** | –.13** | –.13* | 1.00 | | | | | | 3.82 | .98 | .91 |
| 8 SL ThoughtS. | .00 | –.07 | .08 | .15*** | –.08 | –.12** | .48*** | 1.00 | | | | | 3.41 | .90 | .77 |
| 9 Information Richness | .03 | .20*** | .16*** | .07 | –.09* | –.02 | .10* | –.03 | 1.00 | | | | 3.92 | .72 | .81 |
| 10 Autonomy | –.11* | –.04 | .10* | .32*** | –.04 | –.35*** | .14** | .13** | .16*** | 1.00 | | | 4.14 | .88 | .69 |
| Outcomes | | | | | | | | | | | | | | | |
| 11 Cognitive stress (1–5) | .17*** | –.20*** | .01 | –.09* | –.05 | .07 | –.18*** | –.03 | –.29*** | –.20*** | 1.00 | | 2.17 | .76 | .88 |
| 12 Performance (1–10) | .09* | .08 | –.02 | .05 | –.11* | .02 | .26*** | .14** | .19*** | .03 | –.30*** | 1.00 | 8.07 | 1.14 | – |

SL Goals = Self-leadership Goal-setting, SL ThoughtS = Self-leadership Thought Strategies.
* $p < .05$, ** $p < .01$, *** $p < .001$.

**Table 3:** Means, standard deviations, and results of Kruskal-Wallis one-way analysis of variance regarding office type.

| | ABWE Activity-Based Working Environment Mean (*SD*) | Non-ABWE Cell Office 1–3 people Mean (*SD*) | Non-ABWE Landscape 4–25 + people Mean (*SD*) | $\chi^2$ |
|---|---|---|---|---|
| N | 416 | 30 | 64 | |
| Background | | | | |
| Gender | 39.7% female | 16.7% female | 50.0% female | 9.49** |
| Age | 42.28 (9.13) | 37.17 (7.90) | 44.64 (10.24) | 15.00** |
| University | 69% university | 70% university | 75% university | .90 |
| Resources | | | | |
| SL Goals | 3.91 (.92) | 3.33 (1.30) | 3.48 (1.04) | 15.58*** |
| SL ThoughtS | 3.48 (.87) | 3.13 (1.13) | 3.13 (.93) | 10.24** |
| Info Richness | 3.94 (.72) | 3.66 (.66) | 3.88 (.78) | 5.49 |
| Autonomy | 4.28 (.76) | 4.02 (.81) | 3.33 (1.19) | 46.28*** |
| Outcomes | | | | |
| Cognitive stress | 2.14 (.75) | 2.33 (.90) | 2.30 (.76) | 3.77 |
| Performance | 8.10 (1.12) | 7.57 (1.33) | 8.13 (1.13) | 5.27 |

SL Goals = Self-leadership Goal-setting, SL ThoughtS = Self-leadership Thought Strategies.
* $p < .05$, ** $p < .01$, *** $p < .001$.

**Table 4:** Regression results: Effects of predictors on cognitive stress and self-rated performance, respectively. $N = 507$.

| Variables | Cognitive stress[a] | | | Performance[a] | | |
|---|---|---|---|---|---|---|
| | Step I | Step II | Step III | Step I | Step II | Step III |
| Background | | | | | | |
| Gender (1 = m, 2 = f) | .15** | .15** | .15** | .10* | .09* | .08 |
| Age | –.18*** | –.18*** | –.12** | .08 | .07 | .02 |
| University | –.02 | –.02 | .05 | –.01 | –.01 | –.07 |
| Office environment relative to ABWE | | | | | | |
| Cell Office | | .05 | .01 | | –.09* | –.05 |
| Landscape Office | | .08 | –.01 | | –.00 | .04 |
| Resources | | | | | | |
| SL Goal-setting | | | –.16** | | | .22*** |
| SL Thought strat. | | | .05 | | | .05 |
| Info Richness | | | –.23*** | | | .16*** |
| Autonomy | | | –.15** | | | –.01 |
| Adjusted $R^2$ | .06 | .06 | .16 | .01 | .01 | .10 |
| $\Delta R^2$ | .06*** | .01 | .10*** | .02* | .01 | .09*** |

[a] Estimates are standardized regression coefficients, $\beta$-values.
* $p < .05$, ** $p < .01$, *** $p < .001$.

## Discussion

The aim of this study was to examine the impact of different resources, namely self-leadership, information richness, and autonomy, on employee cognitive stress and performance in an activity-based working environment as compared to more traditional office settings. Results show that the type of office environment did not influence cognitive stress or performance significantly, but rather that presence and usage of personal and job resources are what explain most of the variance found. For cognitive stress specifically, the demographic variables gender and age also account for some variance.

### *Resources and performance*

#### Self-leadership and performance

Results only partly supported the hypothesized influence of self-leadership on performance; as it turned out self-leadership goal-setting explained the most variance, while self-leadership thought strategies had no significant impact at all. The positive effects of goal-setting on performance have been well studied (Locke and Latham, 2006), but we do find it interesting that it is the part of self-leadership most related to orientation and navigating ambiguity that was shown to have a relationship. Self-leadership, as it has been conceptualized by Manz (1986), has the goal to increase intrinsic motivation. In a review of work design literature, Parker (2014) has argued that designing modern jobs for motivation is 'necessary, but insufficient'. To the extent that work can be characterized as decreasingly reliant on external regulations and standards (Allvin et al., 2006), even if workers are very motivated, the problem of navigating an ambiguous and 'free' working environment must be solved to enable performance and manage overload. From this perspective, it makes sense that structuring acts, such as goal-setting, have an impact while motivating thoughts do not.

#### Information richness and performance

Information richness was the other resource explaining any variance in performance. Conceptually, information richness feeds into goal-setting in various ways. Tangential to information richness, perceptions of situational constraints influence goal commitment (Klein and Kim, 1998), feedback is a key moderator enabling individuals to monitor their progress, and not least, task knowledge is a prerequisite for setting adequate goals and for performance (Locke and Latham, 2006). In a complex and ambiguous working environment, solving novel problems in changing constellations of people, having adequate task knowledge is not going to be a stable property of an individual, but rather depend on a flow of work relevant information, i.e. an information-rich environment. Weick, Sutcliffe and Obstfeld (2005) write of sensemaking that it involves 'turning circumstances into a situation that is comprehended explicitly' which then turns into a 'springboard for action'. Looking at the factors together, the compound variance explained when having both timely access to work relevant information (IR) and practicing formulating and setting goals for yourself means employees are well poised to perform both in ABWE and other settings requiring proactive behaviors from employees.

### *Resources and cognitive stress*

#### Information richness, goal-setting, and cognitive stress

For cognitive stress, self-leadership goal-setting, information richness, and autonomy all had a significant impact, and of these, information richness had the most weight. We hypothesize that this is the case because information richness may contribute to an enriching of the psychosocial work environment with relevant cues, thereby enabling sensemaking and the construction of actionable knowledge, stabilizing (however fleetingly) the boundaries of work. This would work to counteract the ambiguity and uncertainty of weak situations (Allvin et al., 2013; Weick et al., 2005). Goal-setting, similarly, is a sensemaking process that stabilizes the psychological boundaries of work, increasing clarity. This stabilization lowers uncertainty and thus the amount of cognitive resources that have to be allocated to a particular issue, thereby *conserving* resources, from a COR perspective (Hobfoll, 1989). Setting goals involves thinking about and setting intentions for the future, which is effortful mental work. A recent study by Sjåstad and Baumeister (2018) showed that being mentally depleted reduced willingness to plan for the future. Stress has previously been shown to tax cognitive resources, which may leave people with insufficient resources to exercise effective self-regulation (Keinan et al., 1999). However, having made a plan is very helpful later as it provides instructions for oneself about what to do, thereby lowering the mental load (Sjåstad and Baumeister, 2018: 138), suggesting the net effect of setting goals or making plans is positive. And so, it is about as likely that cognitive stress may lower self-goal-setting as the opposite effect, that self-goal-setting lowers stress.

#### Self-leadership and cognitive stress

Previous findings that self-leadership lowers stress (Unsworth and Mason, 2012) were replicated here for goal-setting only. Though self-leadership plausibly could influence stress through changing appraisals of situations, in this study, it seems rather to be through the structuring influence of goal-setting only that stress and performance are affected by self-leadership. Qualitative research by the first and second author has indicated that thought based self-leadership strategies are not effective protecting against cognitive stress (Bäcklander, Rosengren and Kaulio, forthcoming), a finding mirrored in these results.

#### Autonomy and cognitive stress

A rich history of research has established the importance of autonomy as a job resource (Jones and Fletcher, 2003), and one likely to impact many outcomes. In line with previous empirical studies, and in line with stress theories, we found a relationship between autonomy and cognitive stress in which higher autonomy was related to lower cognitive stress. Autonomy likely protects against stress since it both allows some control for the individual over what happens to her and since it allows for many different ways of coping with demands (Bakker et al., 2005).

### *Effects of activity-based working environment*

By showing essentially a zero relationship between office type and cognitive stress and performance, results are actually in line with previous research showing mixed effects of ABWE on health, satisfaction, and performance (Wohlers and Hertel, 2017). This indicates that other factors and practices are what explain variance in such outcomes – factors and practices that include but are not limited to the types of resources we examine here. There are two important caveats to note here. First, to find a

very small difference between groups, the comparison groups are too small. Second, one might consider what is truly 'left' of interest in the working environment once you start holding constant various resources, as in the regression analysis in this study. How work is organized, for example how much employee autonomy is granted, is of course part of the working situation as a whole. The configuration of resources could very well itself be related to the type of office environment.[1] In this study the *main* interest was to examine the relative weights of resources especially relevant to navigating the ABWE, in their relationships to stress and performance; thus not factoring in the possible impact of office type would have been an oversight.

Looking at group comparisons in **Table 3**, we see that the ABWE group is highest on all resources, though not significantly so for information richness. In spite of this, as a group, they are not significantly different on cognitive stress or performance. It is *possible*, though a cross-sectional study such as ours is insufficient to determine this, that ABWE does entail, in some ways, a more demanding working situation, but that in practice this is indeed countered by increased personal and job resources available, i.e. more resources are needed to achieve the *same* outcomes. What is measured here is thus the 'net effect' of both demands and resources, measured or not, that the different office settings have on cognitive stress and performance.

### Control variables

Of the control variables, it is interesting to note that age was a strong *negative* predictor of cognitive stress. That is, younger workers experienced more cognitive stress than did older workers, contrary to what one might expect as an effect of aging alone. Age correlated significantly with information richness, but in the regression, they both retain explanatory power. Older workers likely have more experience in their jobs, which could buffer them from overload.

### Limitations and future directions

The present study has some limitations. First of all, it is a cross-sectional study and so we can make no conclusions about causality. It does have comparison groups, though these are not of a similar size to the main ABWE group. However, we have tried to keep the list of variables tested short so as not to 'overburden' small cells with many variables in the regressions. We have not examined any personality traits such as need for control, emotional stability, or openness, which are also likely to be of relevance in an ambiguous or frequently changing working environment. The only variable directly relating to the individual, except for demographic variables, is the extent of self-leadership they do.

Further, workgroups and dyads (manager-employee) that work better or worse together is another factor likely to impact stress and performance, though there may be no a priori reason to expect this to differ between ABWE, cell offices, or landscape offices. If one wishes to fully evaluate the effects of ABWE on stress and performance, more factors should be considered. This paper has been smaller in scope, focusing on resources especially relevant to the self-organizing idea in ABWE. The total variance explained of the full model is 16% and 10% for cognitive stress and performance, respectively.

The Information Richness scale we created may be borderline 'tautological' since it was reduced from 13 to 5 items, i.e. perhaps too narrowly defined. Further work to validate the scale should be done.

Further research is needed to probe some of our proposed mechanisms, which we relay here through reasoning but which we did not have the data to test, for example, that information richness and goal-setting contribute to lowered cognitive stress through something akin to role clarity. One can also question how to conceptualize self-leadership in ABWE seeing that most of the measurement used had no significant impact on the outcomes. Giving yourself mental pep talks or visualizing success didn't lower stress and it did not improve performance, compared to the more concrete actions of setting goals. The self-management needed to succeed in ABWE should probably be re-cast as more concrete work-focused behaviors, suggesting other measures be used in future research of self-management in ABWE.

### Practical implications

Results support our hypothesis that the orienting and coordinating resource of information richness is important for knowledge workers to do their jobs, both in supporting their performance and protecting against cognitive stress, especially in combination with self-leadership goal-setting. Information richness is a feature of the organization and the social working environment, and to a lesser degree something that the individual is controlling herself, though of course individuals can also seek out information intentionally. SLGS, however, is a discretionary behavior, though employers may encourage employees to engage in it, and teach them how, if necessary.

The 'richness' of 'information richness' connects to the possibility for sensemaking, and not a massive glut of information which could just as easily be construed as 'information overload'. Rather, it is about *enriching* the situational judgment for employees, i.e. when employees have access to relevant, clear, timely, and comprehensible information, the goals they set for themselves, the decisions they make and the discretionary actions they take will all be better informed. Informed, *discretionary* action also carries information back into the organizational system as signals to other employees about priorities, what is valued, and so on. This differentiates a rich situation from a strong situation (Judge and Zapata, 2015; Mischel, 1977). In the latter, an employee may suspend judgment in favor of complying with a strongly structured situation, while in a rich situation, the organization can benefit from the judgment of many individuals, free to act but with plenty of orienting cues available. This suggests that when organizational situations cannot be strongly structured, for example, because the best work process is not known, innovation or different collaboration constellations

are needed; they need instead to be enriched so that employee orientation and coordination does not become too much of a burden on the individual employee, disrupting cognitive functioning and performance. This supports Hackman's (2009) tenet that it is useful to focus on the conditions of work over individual adaption to a possibly bad situation, at least to counter stress. We should not be led to believe that because the individual has greater autonomy and discretion over what to do, they should focus on themselves only. As socially and materially situated beings, we can use discretionary effort to co-create situations, settings, and relations 'upstream' that will affect the performance and strain of work, rather than focusing on effortful downstream individual thought strategies.

From a practical point of view, results indicate that the information environment of employees should be carefully tended to so that information is reliable, timely, easily accessible, and understood, and that while employees should have autonomy, as far as self-leadership goes, employer initiatives should probably focus more on concrete skills like goal-setting and less on 'motivational thinking'.

## Conclusion

The present study examined the relative weights of different resources related to the capacity for self-organization, a key mechanism for activity-based working environments, and their relationship to the employee outcomes of cognitive stress and performance. Specifically, we found that timely access to work-relevant information (what we call information richness), autonomy, and goal-setting were significantly related to lower cognitive stress, and that goal-setting and information richness were significantly related to higher performance. Self-leadership did not significantly relate, as a whole, to these outcomes – only the goal-setting aspect of self-leadership. In conclusion, the study highlights that the self-leadership needed to navigate ABWE likely depends less on motivating thought strategies and more on structuring behaviors and access to timely and reliable information. To facilitate orientation and coordination, organizations may seek to enrich situations, rather than introduce stricter control or do nothing and rely only on employee self-leadership.

## Note

[1] Thank you to an anonymous reviewer for pointing this out.

## Competing Interests

The authors have no competing interests to declare.

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