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## Curvilinear Relationships Between Age and Job Performance and the Role of Job Complexity

## Abstract

Despite suggestions that work performance varies with age, the empirical evidence is inconclusive and contradictory. Possible reasons for this are not differentiating between the various types of performance and a naive assumption of a negative linear relationship between age and performance across the working lifespan. With this study we refute these expectations. We take a lifespan perspective and draw on time-role transitions to explore differential and curvilinear relationships between age (as chronological age) and three types of job performance (specifically, task proficiency, proactivity, and adaptivity), moderated by job complexity (measured as cognitive demands). Using Bayesian polynomial regression on survey data from 903 employees, we tested the relationships between age and each performance type, with job complexity as moderator. The data indicated a U-shaped age-adaptivity relationship (main effects for job complexity) and an S-shaped age-proactivity relationship that was more pronounced under low job complexity (interaction effect). Importantly, we identify the turning points for these changes, which show midlife as a critical period for changes in performance where the job context itself can make a difference. The findings provide crucial evidence that different types of job performance vary by age and the role of job complexity for proactivity and adaptivity. They can inform ways to support performance for different age groups, monitor job complexity, and support individuals through the working life course. Implications for job design, organizational interventions, and human resource management are discussed.

*Keywords:* age; job performance; job complexity

Understanding the factors linked to performance across the lifespan is a growing priority among governments and organizational researchers (Shultz & Adams, 2007). In the current climate of an ageing workforce and ongoing global challenges in economic and employment conditions, discerning whether performance is stable or changes with age can have substantial implications for managing an older workforce, employability, and sustainability (Dalal et al., 2014; Zacher, 2015). However, existing research does not allow for conclusive evidence on the direction or shape of this relationship: some studies indicate that performance increases with age, others that it decreases, and others that the two are unrelated (for reviews see Warr, 1994; Sturman, 2003; Waldman & Avolio, 1986; McEvoy & Cascio, 1989).

There are two possible reasons for this. First, the majority of research has tended to neglect the life-course perspective. Different age periods are characterized by different challenges, brought by changes in needs and priorities, life stages, and individual differences such as abilities and competencies (Heckhausen, 2001; Lachman, 2004). Indeed, there is some evidence from work psychology and organizational research that performance differs in different age group: an initial increase in performance, which is followed by a plateau (Avolio et al., 1990; Hofmann et al., 1992; McEvoy & Cascio, 1989; Sparrow & Davies, 1988; Schmidt et al., 1988; Sturman, 2003; Ng & Feldman, 2008). It is thus possible that the commonly reported near-zero correlation between age and performance masks curvilinear effects (McEvoy & Cascio, 1989; Strauss et al., 2015a, 2015b) of changes over time. Applying a life-course lens to understanding performance can illuminate how and why it varies with age.

Second, research has tended to examine on-the-job or work-role performance as a one-dimensional construct. Often erroneously equated to productivity (Koopmans et al., 2011), performance has been measured as, for example, sales quotas (Porath & Bateman, 2006), trainability (Gordon et al, 1986), job knowledge (McDaniel et al., 1998), or team building and work facilitation (Wright & Bonett, 2007), using a range of data sources such as supervisory ratings, peer ratings, and self-reports (McDaniel et al., 1998; Waldman & Avolio, 1986; Wright & Bonett, 2007). However, there is consensus that self-rated work performance is a multidimensional construct (Griffin et al., 2010; Ng & Feldman, 2007; Koopmans et al., 2011) that reflects a range of positive work behaviors. Griffin, Neal and Parker (2007) identified the core dimensions of work role performance as proficiency, proactivity, and adaptivity, whereas Koopmans et al. (2011) mirrored these as task, contextual, and adaptive performance (a fourth dimension, counterproductive work behavior, is beyond the scope of this study). An acknowledgement of performance as a multidimensional construct is necessary (Sturman, 2003) to fully understand how it varies with age. Thus, because human functioning, needs, goals, and psychological and tangible resources change across the life-course, different types of performance will have different trajectories with age.

The aim of this study is to examine the relationships between age and work role performance. We apply a life-course lens to explore change and stability in three types of performance and examine the job context as a potential moderator. As the current evidence is inconclusive, we use a hybrid of a confirmatory and exploratory approach. We revisit relationships examined in past work and extrapolate on relationships not yet examined; we therefore consider these analyses exploratory. It is also beyond the scope of this study to consider all types of performance; rather we focus on three types of positive role behavior. In what follows, we define work performance, outline the life-course perspective, review the

evidence on differential relationships for age and three types of performance, discuss the role of job complexity in this relationship, and finally present the study and its findings.

### **Understanding Performance**

Job performance is about applying one's abilities and resources to the needs of the job and the organization. There are several propositions on what facets a multidimensional view of performance should consider (e.g., Griffin et al., 2007; Ng & Feldman, 2007; Koopmans et al., 2011). A first distinction is that of task performance (behaviors focused on completion of tasks defined in the formal job description) vs contextual performance (or citizenship – positive behaviors focused on organizational efficiency that also enhance completion of job tasks; Motowidlo & Scotter, 1994). *Task performance* or *task proficiency* is the competency with which an individual meets goals and performs central tasks of their job (Koopmans et al., 2011) – it captures competency or effectiveness on the job under relatively stable and predictable situations (Griffin et al., 2007; Griffin et al., 2010). It represents the narrowest definition of performance and the largest, and most conclusive, body of research on the relationship between age and performance (Griffin et al., 2007). But performance is more than meeting job role expectations: it also covers behaviors that support the broader environment of 'the technical core' (Koopmans et al., 2011) and contribute to broader organizational goals (Rotundo & Sackett, 2002).

To *task proficiency*, Griffin et al., (2007) added *proactivity* and *adaptivity*, to include behaviors that describe "individuals adapt to changing conditions and proactively act to anticipate new challenges" (Griffin et al., 2010). Whereas task proficiency is about responding to predictable situations, proactivity and adaptivity are more change-orientated, forward-looking, and appropriate in unpredictable situations or uncertain work environments (Griffin et al., 2010) but also important for supporting task performance (Motowidlo, 2000; Koopmans et al., 2011), and not individual but also team and organizational effectiveness

(Griffin et al., 2007, 2010). Furthermore, “proactivity emphasizes self-initiated change to actively change the self or the environment, whereas adaptivity emphasizes successfully accommodating the uncertainties of externally initiated change” (p. 175, Griffin et al., 2010). This capacity to change and adapt to the needs of the situation and achieve ‘dynamic fit’ is essential (De Vos et al., 2018) also because it can support sustainable development by supporting career growth, continuity (De Lange et al., 2015), and creation of opportunities (Holling, 2001).

These three facets of performance reflect the shift towards viewing performance as a dynamic behavior (Tims & Kooij, 2015) that includes an element of within-person variability (Dalal et al., 2014). This shift makes practical and conceptual sense. It is relevant to a life-course perspective and its essential elements of change and adaptation. It implies a key role for individual differences such as age and developmental or career stages in performance. It places the individual in the center, not as a passive recipient, but as an actor who defines his/her relationship with work and responds to environmental influences.

### **Job Performance and Age**

Adult ageing is characterized by loss, growth, reorganization, and exchange (Kanfer & Ackerman, 2004), with changes in resources, roles, and goals. As a proxy to work experience, age has been used as an indicator of job performance (Rowe, 1988). Common views of ageing at work are characterized by a contradiction between focusing on declines in capacities that give rise to age stereotypes (Posthuma & Campion, 2009) and the expectation that age and work experience confer sought-after skills and abilities (Oswick & Jones, 1991).

Ageing brings natural declines in physical, mental, and cognitive abilities (Fitzgerald et al., 2013; Ng & Feldman, 2007, 2008; Kenny et al., 2008; Kunze et al., 2013; Verhaeghen & Salthouse, 1997). The more ‘visible’ changes fuel negative age stereotypes of older workers as poorer performers (Toomey & Rudolph, 2017), with a lower ability to learn and

acquire new skills (Warr & Birdi, 1998), eagerness to retire (Toomey & Rudolph, 2017), poorer health (Goldstone & Jones, 2001), lack motivation and energy (Warr & Fay, 2001), resistance to change (Kunze et al., 2013), and limited flexibility and innovativeness (Van Veldhoven & Dorenbosch, 2008).

However, declines in some capacities do not necessarily lead to declines in performance. Empirical research that takes a broader perspective contradicts common negative stereotypes. For example, one of the first investigations into the relationship between age and aptitudes, Hirst (1958) found that although aptitudes (i.e., general intelligence; verbal, numerical, and spatial aptitude; motor coordination) increased up to age 30-37 and then dropped, only decrease in motor coordination predicted decrease in on-the-job performance. Some capacities remain stable through life (such as crystallized intellectual abilities linked to experiential learning; Kunze et al., 2013) and others increase with age (such as job knowledge and psychosocial resources; Zacher & Kooij, 2017). Importantly, a range of compensation strategies support those capacities that decrease with age (Zacher & Kooij, 2017). Older workers bring psychological, intellectual, emotional, and social capital (Peters & Spicer, 2005) and have increased motivation compared to younger workers (Peters & Spicer, 2005). Positive age stereotypes portray older workers as reliable and loyal (D'Amato & Herzfeldt, 2008; Sternberg et al., 1994), with abundant experience (Brooke & Taylor, 2005), able to think strategically and apply accumulated wisdom (Fitzgerald et al., 2013). Therefore, gains and losses, growth and decline, characterize progression through life (Heckhausen, 2001; Fuller-Inglesias et al., 2009; Kanfer & Ackerman, 2003), defying a straightforward answer to the question of how performance changes with age.

Furthermore, individual agency also plays a role in growth and decline. Individuals select goals to focus their efforts, optimize resources to achieve these goals, and compensate for potential losses by applying alternative means to achieve these goals (selection



optimization and compensation [SOC] theory; Bajor & Baltes, 2003). Strategies for dealing with loss become increasingly important in older age as losses-to-gains ratio changes (Baltes, 1987). Indeed, middle aged and older individuals report higher use of SOC strategies (Freund & Baltes, 2002). Older workers are better able to deploy resources to cope with change, distinguish between important goals, and be more willing to adapt to change (Kunze et al., 2013).

Applying a lifespan lens can help to further understand the age-performance relationship. Lifespan research is grounded in the idea that human development brings changes in resources (Baltes & Dickson, 2001). Although, as can be expected, an accumulation of resources over the lifespan supports better adaptation to losses related to ageing (Baltes & Lang, 1997), the deficits-breed-growth mechanism (Baltes et al., 1999) suggests that both gains and resources are important for human adaptation and development because losses can fuel adaptive capacity and the application of proactive strategies (Zacher & Kooij, 2017).

### **Changes Throughout the Working Lifespan**

There are three broad stages of adulthood: early or exploration (18-30), middle or establishment (25-49), and late or maintenance (45-65) (Levinson, 1986). These typically overlap and are variable across the lifespan rather than static (Huffman et al., 2013). The early life stage is characterized by identity exploration and a minimal role strain, and is manifested through experiences such as furthering education, starting a career, or a family (Huffman et al., 2013; Erikson, 1968). Key concerns include education, child-rearing, and career establishment (Lachman, 2004). The middle stage is characterized by progressively more responsibilities in all life domains. Multiple roles can lead to conflict and, in turn, to poor integration in the workplace (e.g., reduced job performance and commitment, higher accident rates and turnover) (Biddle, 1986) heightening opportunities for role conflict and

consequences of ambiguity, discontinuity, and overload. Key concerns include child-rearing, career changes, pre-retirement planning, the menopause, and the empty nest (Lachman, 2004). Finally, the late stage is characterized by integration of life experiences and a shift in goals from work towards family and leisure domains (Huffman et al., 2013). Furthermore, "responsibilities in work and family roles are lower, more resources are available, values that can support coping with and managing multiple demands are better developed (Huffman et al., 2013), and relationship quality is more stable (Lachman & Firth, 2004). Key concerns include retirement, care-giving, the empty nest, and grand-parenting (Lachman, 2004).

Midlife "holds a sandwich position" (Heckhausen, 2001): a unique "age-temporal position in the life-course" between the first half, characterized by predominant growth processes (e.g., development of expertise, improved emotional functioning), and the second half, characterized by predominant losses (e.g., declining physical functioning, a restricted time perspective) (Heckhausen, 2001). In midlife, there seems to be an accumulation of losses or disadvantages (Glymour et al., 2009) and gains or resources for work motivation (Kanfer & Ackerman, 2004) and health (Fuller-Inglesias et al., 2009) and also "a reorganization of personality and affect, often in some form of discontinuity" (p. 447, Kanfer & Ackerman, 2004). Reorganization and exchange (Kanfer & Ackerman, 2004) are also evident in time-based role change transitions, such as becoming a parent, and exit transitions, such as state or role changes (Fuller-Inglesias et al., 2009) as individuals progress through the education, career, and family pathways. Time-based role change transitions both place demands (e.g., from one's family or career) and boost the capacity to adapt and be proactive (Fuller-Inglesias et al., 2009; Zacher, 2015). However, the benefits are delayed: the resources that are necessary to cope and manage more excessive work and non-work demands are not yet developed (Huffman et al., 2013), compromising successful coping. Indeed, Clark, Oswald & Warr (1996) observed an inverted-U pattern for age and job satisfaction and

mental health, suggesting that “both job satisfaction and context-free mental health are affected by non-job factors of life-stage and personal circumstances” (p. 57).

### **Differentiated Relationships Between Age and Performance**

If different stages of the working lifespan are associated with changes in goals, roles, and resources, then different facets of performance will have different change trajectories with age. Next, we explore possible disruptions in task proficiency, adaptivity, and proactivity across the life-course. Note that in this study we use a continuous measure of age but apply life stages to understand when and how different facets of performance may change.

#### ***Age and Task Proficiency***

Task proficiency can vary with changes in skills and knowledge (Motowildo & Scotter, 1994), abilities and experience (Skirbekk, 2008). As mentioned, early cross-sectional research indicated that the quality of job performance increases with age but only up to a certain point after which it starts to decrease (Sparrow & Davies, 1988; McEvoy & Cascio, 1989). Supervisor ratings also support a positive age-performance relationship, with performance declining from the fourth decade of life (Avolio et al., 1990). Meta-analytical research has rebuffed the idea of an inverted U-shaped relationship between age and performance because of the complexity of the person-situation context that determines specific outcomes, limiting our ability to generalize on the relationship across the lifespan (Sturman, 2003).

The difficulty to extract a universal relationship between age and task proficiency may be explained by a number of reasons. First, some physiological and cognitive changes only start in the final decades of working life and before retirement (i.e., 45-65; Levinson, 1986; Shephard, 2000) but the exact timing shows a lot of intra-individual variability. Second, physiological and cognitive changes may be compensated for or moderated by a

broad range of contextual work factors such as the type of task (Riby et al., 2004), work experience (Peeter & Emmerik, 2008; Ilmarinen, 2006), instability of the work environment (Niessen et al., 2010), or promotion to more demanding jobs (Sturman, 2003). Finally, in later working life stages, gains are accrued in experience and resources (e.g., social support, marital status, stable friendships, social mobility, socioeconomic status) that can match increasing work challenges, promote adaptation, and offset physiological and cognitive losses (Heckhausen, 2001). Thus, following Sturman (2003), the relationship between age and task proficiency is highly idiosyncratic to contextual characteristics.

### ***Age and Proactivity***

Proactivity has been conceptualized as initiative, innovative work behavior, voice, job crafting, feedback seeking, and career management (Zacher & Kooij, 2017). It has two broad dimensions: on-the-job proactivity, in terms of responding to changes in the work environment in order to optimize performance, and developmental proactivity, in terms of seeking opportunities to learn and develop new skills in order to remain employable (Van Veldhoven & Dorenbosch, 2008). We adopt the definition of proactivity as personal initiative (Warr & Fay, 2001) or self-initiated behavior that has a direct impact on the individual or their environment in the workplace (Grant & Ashford, 2008). Daily proactivity is associated with higher evening fatigue day and higher daily cortisol levels, possibly through the effect of increased cognitive demands (e.g., goal setting, planning, monitoring) as a repose to unplanned or non-routine work (Fay & Huttges, 2017). Furthermore, proactivity is linked to overall job performance (Grant et al., 2009) and withdrawal behaviors such as absenteeism (Greenglass & Fiksenbaum, 2009).

Despite calls to focus on age in order to better understand proactive performance (Fay & Sonnentag, 2010), we have little empirical evidence on how proactive behaviors may change with age (Zacher & Kooij, 2017) and how, in turn, this may impact on job

performance. We know that motives related to proactive behavior, and therefore its outcomes, change over the working life source (Kooij et al., 2011) and that proactivity is an aspect of the psychological and emotional capital that individuals acquire in their later working life stage (Peterson & Spiker, 2005).

Proactivity will be higher in the early life stage as individuals are more open to new experiences, are exploring opportunities and options, and strive to build resources (Zacher & Kooij, 2017). For midlife, the picture is less clear. The midlife stage can pose challenges to enacting proactivity as an extra-role behavior because of time-role changes, role conflict, and delayed accumulation of resources in the face of increasing demands. There are two conflicting forces at play. On the other hand, the establishment phase and a growing career also demand more resources, potentially leading to an upward trend in proactivity, if these are available. On the other hand, when needed regulatory resources needed to balance multiple commitments and demands are scarce, individuals will have less flexibility or capacity to initiate change behaviors. They may have to choose the areas (of growth and maintenance) in which they can invest resources (Heckhausen, 2001) the difficulty of balancing the responsibilities that a new family brings with existing work commitments (Karanika-Murray & Cooper, 2020). Thus, “this situation of conjoint growth and decline requires a differentiated approach on the part of the midlife person” (p. 349, Heckhausen, 2001). Thus, growth and decline may counteract each other leading to a plateau that masks the resource fragility of midlife. Finally, later in life, the accumulation of resources combined with reduced demands due to role transitions may bring positive changes, potentially allowing enacted proactivity to be restored. At the same time, a decline in fluid cognitive ability may affect innovative work behavior and adaptability that is required in innovation (Schaffer et al., 2012). In addition, changes in motives and needs, learning preparedness, preparation for retirement, and a changing time perspective may drive the focus away from

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extra-role behaviors (Kooij et al., 2011; Kooij et al., 2018). Together, these changes may render knowledge goals less salient than emotion goals (see: socioemotional selectivity theory). Therefore, it is possible that proactivity will continue to show a downward trend after midlife.

To further explore this question, we turn to job-related contextual factors. Sturman (2003) examined contextual factors to explain possible curvilinear relationships between age and performance. His meta-analysis showed that a curvilinear age-performance relationship exists for jobs of high complexity, such that, over time, “experience becomes more predictive of job performance in high complexity jobs” (p. 626). More specifically, there is evidence that the relationship between age and innovative work behavior, which is akin to proactivity, depends on contextual factors such as job complexity (Schaffer et al., 2012). Schaffer et al. (2012) showed that proactivity is more stable across the working life span under jobs with higher complexity. Job complexity is defined as the level of stimulating and challenging demands at work (Fried et al., 2002) or the extent to which the work is difficult, requires high-level skills, and is mentally demanding (Morgeson & Humphrey, 2006). Note that job complexity can be measured both objectively by using job titles and subjectively by measuring participants’ perceptions. Subjective job complexity is just as relevant, maybe even more so, than objective job complexity, because the subjective variant captures more how well a person is equipped in terms of their knowledge, skills, and abilities for the job, which might be more essential for performance than objective job complexity per se. Job complexity can foster innovative work behaviors (Shalley, Zhou & Oldham, 2004), perhaps because complex jobs require individuals to attend to multiple elements, deal with ambiguity, and maintain coordination and cooperation. Job complexity is positively linked to work performance (Fried & Ferris, 1987) both directly and indirectly by enhancing the focus on opportunities (Zacher et al., 2010) and helping to focus resources on the task itself.

Therefore, it is possible that after a plateau in proactivity that masks the resource fragility of midlife, job complexity can lead to different trajectories of proactivity in later life.

*Hypothesis 1a: The age-proactivity relationship is curvilinear*

*Hypothesis 1b: Job complexity moderates the relationship between age and proactivity, such that high job complexity supports a positive relationship after midlife*

### ***Age and Adaptivity***

Adaptivity is defined as “the extent to which an individual adapts to changes in a work system or work roles” (Griffin et al., 2007, p. 329). It is a self-regulatory behavior that denotes preparedness and readiness for change, agency, and an ability to negotiate uncertainties (Tolentino et al., 2013). Performing well in a task depends on the ability to adjust to new conditions (Koopmans et al., 2011), to respond to changes in task demands (Betsch et al., 2001), and the ability to adapt to change (Niessen et al., 2010).

The evidence on the relationship between age and adaptive performance is unclear. Mirvis and Hall (1996) argued that “there is no physiological and scant psychological evidence that aging is in any way related to personal adaptability and resistance to change” (p. 285). More recent empirical work reported no significant effects between age and individual adaptability (O’Connell et al., 2008; Kunze et al., 2013). But there is evidence on the importance of and changes in adaptivity with age. On the one hand, a range of psychological resources (such as increased competence, emotional regulation, sense of control or mastery, and social responsibility; e.g., Lachman, 2004; Lachman & Firth, 2004; Lang, 2001) and adaptive capacities (such as emotion regulation and social integration; e.g., Haslam et al., 2009) protect from stressors, minimize the negative of losses that ageing brings, and are essential for adapting to new work challenges. Such psychological resources and adaptive capacities are “robust well into late life” (Wagner et al., 2013) and impact on adaptive performance by “enable[ing] an individual to guide his or her goal-directed activities

over time and across changing circumstances, including the modulation of thought, affect, and behavior" (Porath & Bateman, 2006, p. 185).

On the other hand, major life changes in midlife may also challenge adaptive capacity. As psychological/socioemotional resources start to increase in midlife (Zacher & Kooij, 2017), substantive physical changes (e.g., the menopause) also take place that may be a substantial factor for work performance (Geukes et al., 2012; Scheme & Zacher, 2013). Such obstacles to goal achievement, such as the demands of parenting (e.g., a new family or young children) or progressively more demanding career/work roles (e.g., a new job or a promotion), may inhibit control over and adaptation to life domains (Huffman et al., 2013). Indeed, Huffman et al. (2013) found an inverted-U relationship between age and work-family conflict with conflict was more pronounced in middle age, noting that "factors at work and home are the most taxing on resources". Furthermore, as mentioned earlier, because patterns of change vary greatly across different dimensions (Lachman, 2004), the adaptive resources needed in midlife to deal with increased demands in different life domains may not develop at the same rate to support adaptive performance. Therefore, adaptive resources may be challenged in midlife, even more so due to increased demands, creating a dip in adaptivity in midlife (Scheibe & Zacher, 2013).

If job complexity is important for work performance (Fried & Ferris, 1987; Zacher, Heusner, Schmitz, Zwierzanska & Frese, 2010) and specifically proactive performance, it may also play a role in adaptive performance. As a job resource, the degree of complexity of the job can help to capitalize on age-related resources such as experiential knowledge (Zacher et al., 2009). Specifically, job complexity can help to boost adaptivity because it requires individuals to attend to multiple elements, deal with ambiguity, and maintain coordination and cooperation, and thus supports cognitive and emotional functioning (Frese, 1982),



intellectual flexibility (Schooler, Mulatu, & Oates, 1999), and a good fit between changing needs and abilities in older workers (Zacher & Kooij, 2009). Therefore,

*Hypothesis 2a: The age-adaptivity relationship is curvilinear*

*Hypothesis 2b: Job complexity moderates the relationship between age and adaptivity*

## **Method**

A self-report survey was administered in one large local government organisation council in Great Britain that employed just over 5000 employees in a wide range of job roles. During that time, the organisation was affected by budget cuts, organizational restructuring, and uncertainty that impacted across all job roles, which included administrative staff, senior managers, middle managers, professional workers, manual workers, technical workers, and service staff. Both online and paper-and-pencil survey options were made available. Examination of the characteristics of participants who took part via the two different methods did not reveal any differences in the study variables. Note that in this study we use a continuous measure of age but apply life stages to understand when performance may change.

### **Participants**

In total, 1241 questionnaires were completed, representing a response rate of 24.42%. These rates are consistent with reported rates for online questionnaires (e.g., Kaplowitz et al., 2004) and reflect the start of a period of planned organizational change. After removing cases with missing values, this was reduced to a final sample of 903 participants. The final sample consisted of 61.9% women. Participants' average age was  $M = 43.48$  years (range: 18 – 69); 73.8% had completed secondary education, 19% had an undergraduate degree and 7.1% had a postgraduate degree. Average organizational tenure was  $M = 11.24$  years (range: 0 – 40).

### **Measures**

*Performance* was measured with nine items that captured individual level *task proficiency, proactivity, and adaptivity* (three items each; Griffin et al., 2007). Respondents were asked to indicate to what extent a range of statements had been true in the past month (e.g., “Carried out the core parts of your job well”, “Adapted well to changes in core tasks”, “Initiated better ways of doing your core tasks”, for task proficiency, proactivity, and adaptivity, respectively) on a 5-point Likert-style scale (from 1 = *not at all* to 5 = *a great deal*). Cronbach’s alphas for the three scales were 0.85, 0.91, and 0.81, respectively. The scales are structurally distinct from each other (Griffin et al., 2007) and have excellent reliability in French and Chinese samples (Gagné et al., 2015).

*Job complexity* was measured with four items on cognitive job demands from the Copenhagen Psychosocial Questionnaire (Kristensen et al., 2002). This is in line with Schaffer et al. (2012) who operationalized job complexity as higher cognitive demands. Respondents were asked to indicate to what extent they agreed with a range of statements about their job (e.g., ‘I have to keep my eyes on lots of things while I work’) on a 5-point Likert scale (from 1 = *always*, to 5 = *never*). Cronbach’s alpha for this scale was 0.72.

*Gender* and *tenure* were included as control variables. Overall work performance may reflect non-work commitments at different life stages which differ greatly for men and women (Martin et al., 2020) and with tenure (Sturman, 2003). Although performance expectations may vary by occupational type (Waldman & Avolio, 1986), we found no differences between managers, operational staff, and support staff and therefore did not include job type as a control variable.

### **Analytical Approach**

Following preliminary examinations of the data we identified issues of skewness with the dependent variables that were more pronounced for proficiency and adaptivity. Because we were unable to rectify these issues using logarithmic or reciprocal transformation, we

used a Bayesian regression, which makes skewness an assumption of the model, and specified the model likelihood as a skewed normal distribution. The skewed normal distribution is a generalization of the normal distribution that includes an additional parameter (alpha) to allow for skewed rather than symmetrical distributions (positive values denote that the distribution is skewed to the right and negative values to the left). The Bayesian approach allows to easily estimate this additional parameter in the same way that we estimate all other coefficients in our regression model.

The analysis was performed using R (R Core Team, 2019), Stan (Stan Core Team, 2019) for performing Hamiltonian Monte Carlo, and the brms (Bürkner, 2017) front end to Stan. For all parameters we used the default priors suggested by brms. Specifically, for all the regression coefficients and the alpha parameter the priors used were normal distributions with location set at 0 and scale set at 4 standard deviations. For the error term of the model, we used a student-t distribution with 3 degrees of freedom, 0 location, and scale of 10. These are all weakly informative priors allowing sufficient flexibility for the model to account for any reasonable regression coefficient (and shape for the curves) as well as for fairly large values of skewness. As we did not use informative priors, the key advantage of the Bayesian approach is being able to flexibly fit models with a non-normal likelihood and we would expect a frequentist model with similar assumptions about the form of the likelihood to produce equivalent inferences.

We conducted three polynomial regression models that assessed the relationship between age and task proficiency, proactivity, and adaptivity. For completeness, and although we did not expect an effect for proficiency and hypothesized a quadratic effect for adaptivity and a cubic effect for proactivity, we used the same cubic model for all three. This allowed to explore the possibility that relationships are more complex than anticipated. We employed a

hierarchical procedure of four blocks with tenure and gender as control variables in the first block and adding the first, second, and third-order polynomial terms of age.

To compare model fit after adding each subsequent block, we used Leave-One-Out cross-validation (LOO; Vehtari et al., 2017), a Bayesian information criterion that can be interpreted in a similar way to other information criteria such as the AIC and DIC. To examine model fit, we also estimated the Bayesian analogue to  $R^2$  (Gelman et al., 2018). Each model was tested with four simulation chains and 5000 iterations, 2500 for warm-up and 2500 for sampling. These iterations were sufficient to reach convergence according to the effective sample sizes, and Monte Carlo standard errors. Equally, traceplots and the scale reduction factor (Gelman & Rubin, 1992) showed good mixing of the four chains. To avoid any issues of multicollinearity we used orthogonal polynomial terms, which are polynomial transformations of the original age variable so that they are uncorrelated with each other.

Note a previous examination of variation between work groups/departments did not offer foundations for multilevel analysis so we proceed with the analyses as described.

## Results

Table 1 shows the correlations and means (with standard deviations) for the study variables. The  $R^2$ ,  $\Delta R^2$ , LOO (and  $SE$  of LOO),  $B$  values and their credible intervals (and  $p$  values) for the five blocks for each of the three models are shown in Tables 2, 3 and 4. For proficiency (Table 2), the results showed that the best fit was for the first block that included only tenure of the control variables ( $R^2=0.00$ ,  $LOO = 1041.63$ ,  $SD_{LOO}= 56.83$ ) and that none of the subsequent blocks improved on the model fit. Thus, there was no relationship between age and proficiency, job complexity and proficiency, or a significant interaction between age and job complexity.

[Insert Table 1 about here]

For proactivity (Table 3), the best fit was for the fifth block data ( $R^2=0.10$ ,  $LOO = 2457.57$ ,  $SD_{LOO}= 38.34$ ), which included the linear, quadratic, and cubic components for the effect of age as well as the three interaction effects of each of these with job complexity. For proactivity, tenure had a positive effect but gender did not, job complexity was positively related ( $b = 0.37$ ,  $CI = 0.27 : 0.46$ ), and the cubic term for age was negatively ( $b = -16.15$ ,  $CI = -29.85 : -2.39$ ). In terms of the interaction effects, the only significant interaction was between job complexity and the cubic term ( $b = 3.69$ ,  $CI = 0.20 : 7.17$ ). Plots of this interaction effect (Figure 1) showed that, as hypothesized, the relationship between age and proactivity is curvilinear — specifically, it follows a sigmoid pattern: as age increases, proactivity initially decreases, then reaches a plateau until it starts to decrease again. This pattern is more intense for jobs of low complexity showing sharper reductions to proactivity. In contrast for jobs of high job complexity the second decrease never happens and it seems that there may even be a small increase of proactivity at later life stages.

[Insert Tables 2 to 4 about here]

For adaptivity, the analysis (Table 4) showed that block 3 had the best fit to the data ( $R^2=0.07$ ,  $LOO = 2305.20$ ,  $SD_{LOO}= 42.72$ ) indicating a quadratic relationship between age and adaptivity and that adding a cubic predictor or the interaction between age and job complexity reduced model fit. The results at Block 3 showed positive effects for the two controls (tenure and gender), the main effect for job complexity ( $b = 0.25$ ,  $CI = 0.17: 0.33$ ), and a main effect for the quadratic ( $b = 3.56$ ,  $CI = 1.63 : 5.44$ ) but not the linear term of age. The quadratic solution was identified as a more parsimonious model of adaptivity, since blocks 4 and 5 did not represent an improvement from block 3.

[Insert Figure 1 here]

To identify the points where the relationship between age and proactivity and age and adaptivity change trajectories, we used the tangents of the partial derivatives to identify the

local minima and maxima of the curves (Karanika-Murray et al., 2009). Since we used orthogonal polynomials for the analysis, we first transformed the regression coefficient estimates to what they would have been if we have used the original raw age data. Since proactivity is moderated by job complexity, we estimated the turning points for low, average, and high job complexity. On average, proactivity followed a sigmoid pattern, gradually decreasing until 40.1 years after which point it appeared to plateau and then start decreasing again at 55.3 years of age. For jobs of *low* complexity this pattern was more pronounced with both turning points occurring earlier in life at 37.9 and 49.7 years. In contrast, for jobs of *high* job complexity the pattern seems to be more of a U-shaped rather than a sigmoid curve. Still, there were two turning points whereby proactivity appears to decrease until 29.9, then decreases at a slower pace or plateaus until 44.2 years, after which point it starts to increase again. For adaptivity, job complexity did not have a significant interaction with age and therefore we only estimated the turning points when job complexity was at the average. A U-shaped curve was revealed, whereby proactivity decreased until 41.5 years and then showed a gradual increase until 70.8 (the latter is beyond the range of our data and should only be treated as an extrapolation from the model coefficients).

### **Discussion**

We have found support for the proposition that different types of performance have different trajectories across the working lifespan. Our premise was that different types of job performance vary by age and that these relationships are moderated by job complexity. Our starting points, based on lifespan perspective, were that midlife “holds a sandwich position” (Heckhausen, 2001) of time-role transitions characterized by expanding work and physical challenges but also coupled with increasing socio-emotional resources, and that there is broad variability in the patterns of change in person characteristics and resources that change at different rates (Lachman, 2004; Zacher & Kooij, 2017). One of these resources, job

complexity, can help to support self-perceived performance by supporting flexibility and enhancing positive age-related changes. These starting points sketched an overall picture of the age-performance relationship that defies a simple and straightforward answer as to whether performance increases or decreases with age. To understand this relationship, we looked at differentiation and curvilinearity in performance across the lifespan and included job complexity as an important job-related contextual resource. Indeed, we found curvilinear and differentiated age-performance relationships and a changing shape of these relationships depending on how complex the job is reported to be. We found evidence for non-linearity, albeit modest, and a central role for job complexity in changing performance trajectories.

The data supported a curvilinear relationship between age and proactivity, such that proactivity shows a downward trend across the working lifespan but with a plateau in midlife, and is moderated by job complexity. Job complexity defined both the shape of the curve: U-shaped for high job complexity and S-shaped for low job complexity. It changed not just the shape of the curve but the direction of proactivity: after around 50-55 years of age, proactivity *increased* for high complexity jobs but *decreased* for low complexity jobs. When job complexity is perceived to be low, proactivity plateaus after midlife and then drops further later on. But when the job is cognitively demanding, perceived job complexity reinforces a return of proactivity (a U-shaped relationship). The findings support the beneficial influence of higher job complexity.

This is aligned with available evidence. Not only personal and socio-emotional age-related resources such as self-initiated change and future orientation change with age, but also new roles, demands, and uncertainties may further impede efforts to future-focused responses to unexpected demands and to “proactively act to anticipate new challenges” (Griffin et al., 2010). Ageing tends to bring a loss of aging-sensitive resources (Morgeson & Humphrey, 2006) and a focus away from growth (Zacher & Kooij, 2017). As the selection of

goals to concentrate one's efforts on varies throughout the life-course (Freund & Baltes, 2002), fewer resources will be invested on proactively seeking and dealing with work-related challenges that are allocated a lower priority. It is important to have clarity when studying proactivity: on-the-job proactivity where the individual responds to changes in the work environment in order to optimize performance (what this study focused on) is different from developmental proactivity where the individual seeks opportunities to learn and develop new skills (Van Veldhoven & Dorenbosch, 2008). On-the-job proactive behavior and personal initiative (Warr & Fay, 2001; Grant & Ashford, 2008) may be less important when for those who focus more on establishment and maintenance and away from growth (Fuller-Inglesias et al., 2009).

Increasing job complexity can not only help suppress loss of proactivity after midlife (when job complexity is reported as average) but also help proactivity to recover to early life stages and or even boost proactivity to levels that are higher than the early life stage (when job complexity is reported as high). Thus, higher job complexity can protect a person's future-orientated and forward-planning focus, perhaps because it supports cognitive and emotional functioning (Frese, 1982), intellectual flexibility (Schooler et al., 1999), optimal fit between changing needs and abilities (Zacher & Kooij, 2017), and a focus on opportunities (Zacher et al., 2010). According to the model of preventing and successful proactivity (Kahana et al., 2014; Ouwehand et al., 2007) older individuals are "active, self-constructing, and self-reflecting agents within their environment, capable of shaping their environment rather than only responding to it" (Lawton, 1989; in Zacher & Kooij, 2017). Note that proactivity is different from proficiency and adaptivity in that it requires a more future-orientated and forward-planning (and perhaps job-specific) focus, but both describe a strength to absorb, respond to, or anticipate unexpected demands.



The data also supported a quadratic relationship between age and adaptivity with job complexity determining the shape of the curve: resembling an L-shape for high job complexity and a pronounced U-shape for low job complexity. Job complexity changed not just the shape of the curve but the direction of adaptivity: after midlife, adaptivity more or less *plateaued* for high complexity jobs but *dropped* and then *increased steeply* for low complexity jobs (but did not reach the levels of adaptivity of the early life stage). Increasing job complexity can help to suppress any potential loss of adaptivity levels after midlife. Note that there was a main effect for job complexity but no significant interactions with age.

This is aligned with evidence. Emotional regulation increases with age (Gross et al., 1997) such that older workers are better able to deploy psychosocial resources to cope with organizational change, distinguish between important goals, and thus be more willing or able to adapt to change (Kunze et al., 2013). But the power of adaptivity can be thwarted when a job is perceived to be too complex. It may be that low complexity in the work domain helps to avoid depletion of resources or free up additional resources to support adaptivity a work or in life more broadly. Three psychological capacities can help to explain why adaptivity starts to climb up again after midlife and this unexpected effect for low job complexity. Self-efficacy, the belief that one can manage and carry out new tasks efficiently (e.g., Fay & Frese, 2001) is positively related to adaptive behavior (Griffin & Hesketh, 2003). Self-efficacy increases with experience (Wolters & Daugherty, 2007) but only up to a certain point after which it starts to decrease (Klassen & Chiu, 2010). Hope, as a cognitive capacity, helps to illuminate alternative paths to problems and desired goals and to use motivation and agency-thinking to achieve these (Snyder, 2002; Strauss et al., 2015b). It also peaks in early mid adulthood (30-45 years) and is lowest in adolescence and older adulthood (Marques & Gallagher, 2017). Job morale also follows a similar pattern with adaptivity: it decreases steadily from the first years of employment until middle and late twenties or early thirties,

after which period it increases steadily with age (Herzberg, Mausner, Peterson, & Capwell, 1957; in Clark et al., 1996). Self-efficacy, hope, and job morale may help to replenish adaptivity as a resource when it is most depleted but also needed. In addition to psychological aspects, factors related to work and employment may also explain changes in adaptivity. For example, midlife is a period when accumulated job experience may lead to job status changes such as promotion or job change. But the influence of experience may shift if there are changes in job tasks (Betsch et al., 2001), the work environment becomes unstable (Sturman, 2003), or there are changes in work settings (Niessen et al., 2010).

The data did not support a relationship, neither linear nor curvilinear, for age and task proficiency. Our findings are in line with Ng and Feldman's (2008) meta-analysis which indicated that the relationship between age and task performance is largely unrelated. Given the suggestion that some abilities decrease (e.g., fluid cognitive abilities, health, future time perspective) and others increase (e.g., crystallized cognitive abilities, socioemotional abilities) (Zacher & Kooij, 2017), this is not surprising. Modern work is characterized by enrichment rather than specialization, a broad utilization of skills and abilities, and the importance of fit between the person and the requirements of the work and environment, in terms of their knowledge, skills, and abilities. 'Good work' is work that is aligned to personal needs and abilities, that aspires to meaning, fulfillment, and self-determination — this alignment is highly idiosyncratic.

Our overall findings are in line with the lifespan perspective that highlights midlife as a vulnerable period when demands, capacities, and priorities are changing whilst resources are accumulating, albeit more slowly. As discussed, SOC processes (Baltes & Baltes, 1990; Baltes et al., 1999) that allow the individual to draw on growing social and psychological resources to compensate for biological decline (Lachman, 2004) may have not yet developed sufficiently, supporting this idea of midlife as a vulnerable period. This combination of faster

external time-based role transitions and slower internal resource growth may impose a delay in one's capacity for adjustment. Indeed, there is evidence that both disadvantages (Glymour et al., 2009) and resources accrue over the life-course (Van Dijk et al., 2020) to yield a cumulative effect on outcomes such as health and longevity (Fuller-Inglesias et al., 2009).

### **Implications for Theory and Practice**

We have observed a possible trajectory that some but not necessarily all individuals in the working population may go through. The 'midlife dip' seems to be a universal tendency that is evident in a range of psychosocial outcomes but it also shows variability across individuals. An inverted-U pattern has been observed in happiness and life satisfaction, by both economists and psychologists (Rauch, 2018). Because it is not universal, it allows us to expect and ameliorate negative changes in person characteristics and build on positive changes at different life stages in order to support not only job performance but also more broadly life adaptation.

One of the key implications of our findings relate to understanding how performance can be supported across the working lifespan and developing interventions to achieve this. Changes in characteristics of the workforce necessitate changes in management practices in order to maintain productivity, optimize use of resources, and even address negative attitudes and tackle age discrimination in the workplace (Van Veldhoven & Dorenbosch, 2008). Consequently, a better understanding of the turning points in performance across the working lifespan and the factors that drive these can help to improve knowledge on *when* and *how* to intervene to support different types of performance. For example, optimization and compensation strategies (Bajor & Baltes, 2003) may be most effective when used *before* performance starts to be affected in midlife. In addition, beyond financial considerations, the decision to remain involved in the workforce after retirement relates to the sense of purpose,

meaning, and self-fulfilment (Letvak, 2002), social interaction, and identity (Noonan, 2005) that work brings.

If performance is a function of resources and life stages, then individuals at different life stages would benefit from being able to access different types of resources to achieve optimal performance. For example, flexible work practices may be more beneficial to young parents striving to balance work commitments with family demands (Karanika-Murray & Cooper, 2020); training and development opportunities may be more beneficial to those who are at the early exploration stage and focusing on establishing their career; developing inclusive climates (Van Dijk et al., 2020) may be more impactful at critical points to tackle inequality; whereas age-aware policies and practices would allow to accommodate changing strengths and needs (Gkiontsi & Karanika-Murray, 2016). This does not in any way imply indirect discrimination against certain age groups but argues for taking into account life-stage or age-related factors or, in other words, mainstreaming life stage or age into more life-stage and age-aware policies that can accommodate diverse needs as well as strengths. It is within the employer's remit to support employees' personal resources by showing awareness of changing needs at different life stages, maximizing use of skills as well as of increasing expertise and experience, sense of control (Heise, 1990), and networks (Lachman & Firth, 2004). Ultimately, organizations that are successful in tackling the shortage of younger workers will be those that “fully capitalize on the powerful growth of the new mature workforce” (Dychtwald & Baxter, 2007, p. 35). Sensitivity to time-role transitions across the lifespan is necessary in order to maximize the assets of a maturing workforce.

Our findings highlighted the importance of high job complexity, as perceived by the individual, for both proactivity and adaptivity. Jobs can be redesigned or adjusted to older workers' needs and preferences to increase job complexity in order to maximize its benefits

for maintaining intellectual flexibility (Schooler et al., 1999) and for cognitive and emotional functioning (Zacher et al., 2009), and its focus on opportunities (Zacher et al., 2009).

A note on our use of the term ‘older worker’ is important to make. The broad a range of definitions of an ‘older worker’ put the threshold anywhere between 40 and 75 years (Warr, 2000). The choice depends on the disciplinary lens and purpose of the research. For example, studies on changes in market participation, employability, or skills and attitudes, invariably set the threshold at 50-55, 45, or 40-45, respectively (Brough et al., 2011). Such definitions and thresholds are arbitrary if they are not based on an understanding that the ageing process is changeable and cumulative rather than sudden and episodic (Fuller-Inglesias et al., 2009). They are also inaccurate since change in human capacities is too broad, varied, and multi-faceted to succumb to neat stereotypes and definitions of an older worker. A life-span perspective that looks at age threshold changes by specific target outcomes is more realistic, practical, and also fairer.

Related to the above, careful sampling in this line of research is also warranted. It has been noted that research on age and work outcomes has tended to include a restricted age range (Zacher & Kooij, 2017), that workers over 50 years of age tend to be underrepresented (McDaniel et al., 2012), and that the focus tends to be on young or middle-aged employees under 50 years of age (Ng & Feldman, 2008, 2013). This bias can attenuate relationships or restrict the range of relationships observed (Zacher & Kooij, 2017), compromising the ability to detect curvilinearity (Warr, 1990) and the subtleties of the age-performance relationship. We have avoided such population partitioning by using a broad age-lens but research and theorizing should take into account the whole range.

### **Directions for Future Research**

As mentioned earlier, because of the unbalanced literature on what we may expect and the necessarily hybrid exploratory-confirmatory nature of the study, our findings are

tentative. However, our investigation sketches a number of potential priorities for future research. First, closer attention should be paid to the role of the work environment, the nature of the job, and the contextual factors that may affect the relationship between age and job performance (Ferris et al., 1991; Lawrence, 1988, 1996; Treadway et al., 2005). Ng and Feldman's (2008) meta-analysis showed that age and core task performance are largely unrelated, but they also concluded the relationship is sensitive to socio-demographic characteristics such as race, education, job level, job complexity, job tenure, and organization tenure. Similarly, Avolio et al. (1990), showed that occupational differences can define the relationship between age and performance. Our study showed that this relationship is worth unpacking further. An understanding of the job or occupational context is important for placing work-related outcomes in perspective. Furthermore, different contextual variables can signify different intervention foci: organizational change that focuses on improving psychological climate (e.g., Karanika-Murray et al., 2017), job design that focuses on job enrichment, or age-aware policies and practices (Gkiontsi & Karanika-Murray, 2016). In essence, a closer alignment in research between capacities and resources, demands and priorities, and time-role transitions or cross different stages of the working lifespan can help to better understand trajectories of adaptation, task proficiency, and proactivity across the working lifespan.

It would also be important to explore how the three types of job performance may reinforce each other. A starting point may be to explore what and how different types of resources are selected and optimized, or their lack of compensated for, in relation to different facets of performance. Compensation strategies, for example, are not just appropriate for task proficiency, but may be applied to all three to support overall performance over the lifespan. It is possible that adaptivity and proactivity are used to address changes in task proficiency, but how does this pan out at different life stages? For example, using a daily diary study,

Cangiano and colleagues (2019) found evidence that proactive behavior is strongly linked to higher levels of daily perceived competence and vitality — this implies links between proactivity and task performance, and a focus on the daily minutiae level can help to illuminate the relationship. It may be that specific facets of job performance are enacted as resources, further reinforcing overall job performance. For example, adaptivity may be a resource for task proficiency. Understanding how aspects of performance work together could inform a more dynamic model of job performance across the lifespan.

A further understanding the critical role of job complexity would also be important as a research priority. Job-specific resources play the role of a catalyst in age-related midlife-specific changes, potentially helping to protect performance in late adulthood, and perceived complexity of the job is one such critical resource. More nuanced research on the role of job complexity is warranted. Although job complexity has been positively linked with high job strain and over time (Li, Burch, & Lee, 2017), in our study it was shown to be positively linked to maintaining adaptivity and increasing proactivity. It may be possible that a trade-off of losses and benefits exists, or that priorities and use of resources changes (e.g., higher use of SOC strategies with increasing age; Freund & Baltes, 2002), or that other job-related or person-related resources also play a role.

Finally, it is important to apply longitudinal approaches to explore the potential dynamic nature of change in job performance. Time-role transitions may be critical here as they describe how the balance between new demands and increasing capacities can trigger upward and downward changes on different facets of performance. For example, are there cumulative or compensating effects on performance and job resources at specific turning points in the working lifespan? In the field of inequality, Van Dijk et al. (2020) argue that initial inequality can accumulate over time and through a number of mechanisms, such that it becomes more pronounced later in life. Similarly, a dynamic lens can help to understand how

earlier changes in job-related resources can lead to accumulation or resource poverty throughout the life-course that can, in turn, impact differently on job performance. It is possible that losses in capacities and gains in experience counteract each other over time or at certain life transactions. Future research should examine these in tandem and over time.

### **Limitations and strengths**

This investigation is not without some limitations. First, because we used data from one survey wave, we cannot support offer evidence of within-person changes in performance with increasing age. However, we can offer some evidence on the principles that we set out to examine, supported by theory. Second, data were collected via a self-report survey, which may be problematic if a social desirability effect in reporting performance was in force. We have argued that self-perceptions are more relevant for job complexity but objective measures or perhaps a 360-degree assessment of performance could offer a more comprehensive approach. Third, by relying on participants from one large local government organization, it may have offered a civil service perspective of performance where ‘jobs for life’ (although the changing nature of work makes this debatable) may impact on performance, especially proactivity. In our sample, this is unlikely because of the climate of uncertainty with ongoing budget cuts and organizational restructuring in the study organisation.

These weakness are, to some extent, compensated by the strengths of the study, which has offered important insights into the curvilinear and differentiated relationships between age and three types of performance. It has helped to highlight the importance of a more dynamic approach to conceptualising performance and also, with future studies, empirically examining performance to resolve inconsistencies in the age-performance relationship. It has also revealed that the degree of job complexity, as perceived by the job holder, can plant turning points for both their proactivity and their adaptivity on the job.



## **Conclusions**

With this study we have challenged the assumption of a negative linear relationship between age and performance by dis-assembling age into life stages and job performance into different types to examine potentially curvilinear relationships between age and performance against perceived job complexity as a moderator. Changes in adaptivity and proactivity trajectories take place around midlife, as the benefits of time-role change transitions are delayed and acquired after a period of adjustment, which is part of the transition through a vulnerable midlife stage. Central to these changes is the nature of the job itself, with job complexity moderating these transitions to help increase proactivity and sustain adaptivity from midlife onwards. We hope that this preliminary evidence will help to open new avenues for research on how performance changes with age and the important role of job-related contextual resources.

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**Table 1***Pearson's Bivariate Correlations Between Predictor and Outcome Variables*

	<i>M</i>	<i>SD</i>	1	2	3	4	5
1. Age	43.47	10.53					
2. Gender	1.63	0.48	-.029				
3. Tenure	15.08	9.37	.331**	.014			
4. Proficiency	13.44	1.81	-.029	.082*	-.035		
5. Proactivity	10.06	2.91	-.116**	.083*	-.102**	.251**	
6. Adaptivity	10.94	2.75	-.107**	.143**	-.095*	.290**	.612**

*Note.* N = 903; \*  $p \leq .05$ , \*\*  $p \leq .01$ , \*\*\*  $p \leq .001$

**Table 2**

*Polynomial Regression Model for Task Proficiency*

	Block 1			Block 2			Block 3			Block 4			Block 5		
	B	2.5 - 97.5% CI		B	2.5 - 97.5% CI		B	2.5 - 97.5% CI		B	2.5 - 97.5% CI		B	2.5 - 97.5% CI	
Intercept	4.39	4.35	4.44*	4.38	4.31	4.46*	4.38	4.31	4.45*	4.38	4.32	4.45*	4.38	4.31	4.45*
Tenure	0.00	0.00	0.00*	0.00	0.00	0.00*	0.00	0.00	0.00*	0.00	0.00	0.00*	0.00	0.00	0.00*
Gender	0.01	-0.01	0.02	0.01	-0.01	0.02	0.01	-0.01	0.02	0.01	-0.01	0.02	0.01	-0.02	0.03
JC				0.00	-0.01	0.02	0.00	-0.01	0.02	0.00	-0.01	0.02	0.00	-0.01	0.02
Age				0.00	0.00	0.00	-0.02	-0.37	0.35	-0.01	-0.39	0.35	-0.06	-1.77	1.70
Age <sup>2</sup>							0.16	-0.15	0.56	0.18	-0.15	0.59	0.02	-1.73	1.94
Age <sup>3</sup>										0.03	-0.36	0.44	0.01	-2.28	2.21
JC*Age													0.01	-0.46	0.47
JC*Age <sup>2</sup>													0.06	-0.43	0.55
JC*Age <sup>3</sup>													0.00	-0.57	0.59
Alpha	-27.00	-32.00	-22.49	-26.68	-31.47	-22.14	-26.59	-31.32	-22.20	-26.46	-31.37	-21.81	-26.17	-31.13	-21.64
R <sup>2</sup>	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ΔR <sup>2</sup>				.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
LOO	1041.63			1044.84			1046.07			1047.51			1052.61		
SD <sub>LOO</sub>	56.83			56.58			56.54			56.49			56.31		

*Note.* N = 903; JC = Job Complexity; CI = Credible Intervals; Polynomial terms are based on orthogonal polynomials; \* p ≤ .05.

**Table 3***Polynomial Regression Model for Proactivity*

	Block 1			Block 2			Block 3			Block 4			Block 5		
	B	2.5 - 97.5% CI	3.51*	B	2.5 - 97.5% CI	2.69*	B	2.5 - 97.5% CI	2.30*	B	2.5 - 97.5% CI	2.29*	B	2.5 - 97.5% CI	2.30*
Intercept	3.27	3.03	3.51*	2.22	1.77	2.69*	1.89	1.48	2.30*	1.90	1.51	2.29*	1.88	1.46	2.30*
Tenure	0.00	0.00	0.00*	0.00	0.00	0.00*	0.00	0.00	0.00*	0.00	0.00	0.00*	0.00	0.00	0.00*
Gender	0.10	-0.03	0.23	0.09	-0.04	0.22	0.09	-0.04	0.23	0.08	-0.05	0.21	0.09	-0.04	0.21
JC				0.35	0.26	0.43*	0.36	0.27	0.45*	0.36	0.27	0.45*	0.37	0.27	0.46*
Age				-0.01	-0.01	0.00	-2.36	-4.60	-0.11*	-2.51	-4.69	-0.29*	-10.10	-21.04	0.69
Age <sup>2</sup>							2.24	0.14	4.30*	2.82	0.61	5.07*	2.38	-8.76	13.78
Age <sup>3</sup>										-2.40	-4.85	0.09	-16.15	-29.85	-2.39*
JC*Age													2.10	-0.65	4.95
JC*Age <sup>2</sup>													-0.07	-3.02	2.87
JC*Age <sup>3</sup>													3.69	0.20	7.17*
Alpha	-0.54	-1.46	0.57	-0.34	-1.26	0.69	-0.31	-1.25	0.70	-0.27	-1.21	0.75	-0.32	-1.26	0.71
R <sup>2</sup>	.01	.00	.03	.08	.05	.11	.09	.05	.12	.09	.06	.12	.10	.07	.13
ΔR <sup>2</sup>				.07	.05	.08	.01	.00	.01	.00	.01	.00	.01	.01	.01
LOO	2517.13			2461.07			2458.87			2457.71			2457.57		
SD <sub>LOO</sub>	37.06			37.95			38.55			38.24			38.34		

*Note.* N = 903; JC = Job Complexity; CI = Credible Intervals; Polynomial terms are based on orthogonal polynomials; \* p ≤ .05.

**Table 4**

*Polynomial Regression Model for Adaptivity*

	Block 1			Block 2			Block 3			Block 4			Block 5		
	B	2.5 - 97.5% CI	3.62*	B	2.5 - 97.5% CI	3.12*	B	2.5 - 97.5% CI	2.80*	B	2.5 - 97.5% CI	2.82*	B	2.5 - 97.5% CI	2.80*
Intercept	3.42	3.22	3.62*	2.70	2.27	3.12*	2.45	2.08	2.80*	2.45	2.09	2.82*	2.43	2.07	2.80*
Tenure	0.00	0.00	0.00*	0.00	0.00	0.00*	0.00	0.00	0.00*	0.00	0.00	0.00*	0.00	0.00	0.00*
Gender	0.16	0.05	0.28*	0.16	0.05	0.27*	0.17	0.06	0.28*	0.16	0.05	0.27*	0.16	0.05	0.27*
JC				0.22	0.14	0.30*	0.25	0.17	0.33*	0.25	0.17	0.33*	0.26	0.18	0.33*
Age				0.00	-0.01	0.00	-1.35	-3.34	0.68	-1.46	-3.33	0.48	3.72	-5.52	13.04
Age <sup>2</sup>							3.56	1.63	5.44*	3.85	1.85	5.81*	11.47	1.54	21.28*
Age <sup>3</sup>										-1.56	-3.74	0.74	-3.78	-16.88	8.68
JC*Age													-1.31	-3.75	1.07
JC*Age <sup>2</sup>													-2.00	-4.58	0.66
JC*Age <sup>3</sup>													0.64	-2.57	3.94
Alpha	-2.24	-2.89	-1.70	-1.96	-2.50	-1.47	-1.94	-2.51	-1.45	-1.94	-2.49	-1.45	-1.91	-2.48	-1.40
R <sup>2</sup>	.02	.00	.03	.05	.03	.08	.07	.04	.10	.07	.04	.10	.07	.05	.11
ΔR <sup>2</sup>				.03	.02	.05	.02	.01	.02	.00	.00	.00	.01	.00	.01
LOO	2343.80			2316.79			2305.20			2305.30			2308.69		
SD <sub>LOO</sub>	41.24			42.36			42.72			42.74			42.94		

*Note.* N = 903; JC = Job Complexity; CI = Credible Intervals; Polynomial terms are based on orthogonal polynomials; \* p ≤ .05.

**Figure 1**

*The Relationship Between Age and Performance (Proficiency, Proactivity, and Adaptivity) for Different Levels of Job Complexity*

