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Beyond top-down and bottom-up work redesign: Customizing job content through idiosyncratic deals

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Summary Two established approaches to work redesign are formal top-down interventions and proactive bottom-up job crafting. Top-down approaches are limited in their ability to create individually optimized work characteristics, whereas bottom-up processes are constrained by the latitude workers have to modify their own jobs. Following recent research on the idiosyncratic deals (i-deals) individuals negotiate with their employer, task i-deals customizing job content are suggested as a third approach to work redesign. Hypotheses on antecedents and consequences of task i-deals were tested in two studies conducted in the United States and Germany using structural equation modeling. LMX related positively to the extent of successfully negotiated task i-deals, which, in turn, was associated with a more positive evaluation of work characteristics—specifically, higher complexity and control and lower stressors. Work characteristics mediated positive indirect effects of task i-deals on employee initiative and work engagement. Denied requests for task i-deals were associated with a more negative assessment of work characteristics. We conclude with theoretical, practical, and research implications for better understanding and implementing work redesign through i-deals. Copyright © 2010 John Wiley & Sons, Ltd.

Introduction

Job design has evolved from its historical focus on broad-scale interventions targeting classes of industrial jobs (e.g., Rice, 1958; Trist & Bamforth, 1951; Walton, 1972) to customizing individual positions in the service and knowledge sectors (e.g., Feldman & Pentland, 2003; Lawler & Finegold, 2000). Based on the premise that contemporary job design is inherently tied to the nature of the employment relationship, this paper integrates research on job design and customization in

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employment conditions. It develops and tests the construct of *task-related* idiosyncratic deals (task i-deals for short), arrangements that individuals negotiate to create or alter their own job's content.

Idiosyncratic deals, in general, are employment terms individuals negotiate for themselves, taking myriad forms from flexible schedules to career development (Rousseau, 2001, 2005). Although superstars and exceptional individuals have long negotiated distinct terms of employment (e.g., Rosen, 1981), changing labor market conditions have expanded opportunities for a broader array of workers to seek and receive i-deals (Rousseau, 2001). I-deals have become more readily negotiated as employers face market pressures to both attract and retain talent (Cappelli, 2000) and worker expectations for influence over their on-the-job experiences (Freeman & Rogers, 1999). In tight economic times, i-deals can even offset stagnant wages, providing low cost ways to motivate and reward workers (Rousseau, Hornung, & Kim, 2009).

The present study differs from past research in several ways. It amplifies the concept of idiosyncratic deals by developing a form not studied previously, the task i-deal. The role of individual-employer negotiation as a basis for work redesign is examined in two original studies in the United States and Germany. Each tests theory developed here on antecedents and consequences of task i-deals. Placing task i-deals in the context of job redesign responds to Roberts and Glick's (1981) long-standing challenge to job design scholars—developing theory that exposits the psychological dynamics of job content while identifying practical ways of redesigning work to improve worker experiences. This paper locates task i-deals in the broader context of job design approaches (Table 1), distinguishing them from top-down management-initiated job creation (Miner, 1987) and design interventions (Hackman & Oldham, 1980; Miner, 1987), and from bottom-up job crafting (Wrzesniewski & Dutton, 2001; Grant & Parker, in press). In doing so, it calls attention to the overlooked roles in job design of authority and acceptance—two conditions the dynamics of task i-deals make explicit.

Approaches to Work Design

Job or work (re-)design typically refers to setting up or modifying tasks in ways that benefit both workers and their employer (Hackman & Oldham, 1975, 1980). These benefits include more intrinsically satisfying work and greater well-being for employees, along with gains in employee

Table 1. Comparison of work design concepts and their dimensions

Dimensions	Job redesign	Job crafting	I-deals
Initiation	Top-down by management	Bottom-up by worker	Bottom-up typically by worker
Implementation	Planned intervention	Employee discretion	Employee–management negotiation
Authorization	Formal	Unauthorized or within zone of acceptance	Authorized by agents or human resources approval
Employee's role	Typically recipient	Actor	Both actor and recipient
Focus	Job classes or idiosyncratic jobs	Individual job or position	Individual job or position
Primary goal	Intrinsic motivation/ performance	Personal needs	Broad mutual benefit
Design content	Work characteristics	Tasks and interactions	Any or all employment features
Results	Objective changes	Objective changes and/or cognitive redefinition	Objective changes
Process	Discrete event	Ongoing	Intermittent events

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attendance, retention, performance, and proactivity that employers value (e.g., Fried & Ferris, 1987; Parker, Turner, & Griffin, 2003).

All work design approaches are grounded in assumptions regarding where the authority to determine job content resides. Authority is traditionally conceptualized as hierarchical, flowing from the top down (e.g., Barnard, 1938; Urwick, 1945). A close examination of work and organizing processes, however, indicates that authority is multidirectional (Simon, 1997), operating 'upward' and 'sideways' as well. Informal authority operates 'in the day-to-day work of the organization while the formal hierarchy is largely reserved for the settlement of disputes' (Simon, 1997, p. 10). Organizations depend upon cooperation among their members which in turn leads to broader acceptance of the decisions others make: ''Authority is exercised over an individual whenever that individual, relaxing his own critical faculties, permits the communicated decision of another person to guide his own choice'' (Simon, 1997, p. 200). Interdependent parties, including managers, individual workers, and fellow work unit members, need to endorse as appropriate (i.e., part of the job) certain decisions and actions others take in order to accomplish their own work (Barnard, 1938; Khoumakov, 2007).

The array of decisions or actions accepted as part of a job is the *zone of acceptance* (Simon, 1997). It is fundamentally cognitive, representing the beliefs job occupants and their role senders hold regarding acceptable job activities and performance (Katz & Kahn, 1966). The zone of acceptance is subject to bounded rationality and incomplete information (Simon, 1997). Other things being equal, individuals are likely to believe that their understanding of what is acceptable and appropriate is shared by others (Ross, Green, & House, 1977). A proactive worker who alters the way she does her job without apparent objection from others construes it to be acceptable. On the other hand, an objection signals limitations to the zone of acceptance. The critical issue we raise is the basis on which individualized changes in job content are legitimate and acceptable—a matter on which approaches to work redesign take different stances.

Top-down authorization—from job design programs to new job creation

Historically, job design interventions have been management-led, top-down programs to improve worker performance by making a class of jobs more intrinsically motivating (Hackman & Oldham, 1976, 1980; Walton, 1972). In line with traditional employment relations typifying routinized factory and office work (Bendix, 1956; Guillen, 1994), formal job design programs place the authority for job structure with management. Accordingly, managerial decisions regarding organizational and work unit technology and structure have substantial impact on work design (e.g., Rousseau, 1977, 1978). Another top-down approach is formally created idiosyncratic jobs (Miner, 1987). Traditional top-down job redesign limits individualization, emphasizing instead optimum configurations of duties and demands for the average job occupant. In contrast, managers can authorize individually customized idiosyncratic jobs to accomplish a new task or otherwise capitalize on an individual worker's skills.

Both programmatic and idiosyncratic top-down interventions have their limits. Across-the-board redesign targeting classes of jobs, as in the large-scale change projects at General Motors or Rushton, requires enormous company resources (Goodman, 1979; Guzzo & Bondy, 1983). At the same time, a job is unlikely to be well set-up if the capacities and needs of the individual jobholder are not taken into account. Although responsive to individual needs, idiosyncratic jobs tend to be created in an ad hoc fashion. A firm largely populated with idiosyncratic jobs, as in family businesses, faces coordination challenges. To complicate the picture, the qualities the first incumbent brings to an idiosyncratic job tend to set standards that subsequent incumbents are held to (Miner, 1987), undermining future individualization.

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Bottom-up exercise of legitimate action

Workers themselves can redefine, modify, and renegotiate their job roles and duties from the bottom-up (Grant & Parker, in press; Parker & Collins, in press). Proactive individual behavior refers to anticipatory, self-initiated, future-oriented actions that exercise control and introduce constructive changes (Crant, 2000; Grant & Ashford, 2008). Drawing on Wrzesniewski and Dutton (2001), we view task-oriented proactive behavior as job crafting (e.g., in contrast to proactivity directed toward the team or the organization as a whole; Griffin, Neal, & Parker, 2007). Job crafters modify their job's content or its relational boundaries to add meaning, meet personal needs, or impact others the worker cares about (e.g., a hospital janitor taking time to chat with anxious pre-op patients; Wrzesniewski & Dutton, 2001; see also Grant, 2007). Although job crafting principally refers to constructive, legitimate actions, it is not explicitly authorized by the employer. Instead, it occurs as individuals make sense of their work roles (Weick, 1995), trying a different way to accomplish a task, adding a new activity, or dropping a disliked duty to see if its omission matters. A degree of ambiguity can characterize the zone of acceptance a worker experiences with respect to his or her boss or peers (Ross et al., 1977). In consequence, job crafting may generate objections, for example, if the hospital janitor's supervisor complained about him spending too much time chatting with patients (Morrison, 2006). Such objections can lead the worker to re-interpret the zone of acceptance—and, if unwilling to act as a deviant, discontinue those activities, unless subsequent approval is obtained. Depending on whether and how role senders react, job crafting can generate cognitive redefinition and/or objective changes in on-the-job activities that over time stabilize to form the employee's role (Katz & Kahn, 1966).

Unlike top-down approaches, bottom-up redesign can be on-going as personal and organizational needs change. Yet, widespread job crafting without reference to broader interdependencies is a recipe for chaos. As such, employee opportunities to exercise wide discretion over their work tend to be constrained. Seeking additional practical ways to redesign work to benefit both the organization and workers, we now examine the dynamics of task i-deals.

The middle ground—authorization via individual negotiation

I-deals span the spectrum of employment conditions from compensation to training (Rousseau, 2005). Personal flexibility and development are two commonly negotiated types of i-deals (Hornung, Rousseau & Glaser, 2008, in press; Rousseau & Kim, 2006). Flexibility i-deals personalize work schedules; development i-deals are special opportunities for skill acquisition and advancement. Task i-deals refer to the customization of job content. They are specific features of the broader category of development i-deals. The latter include not only job content, but also advancement, promotions, and training (Hornung et al., 2008). By focusing on task-related content, the concept of i-deals can inform work design—a domain previous i-deal research has not explicitly addressed. The observation that employees use negotiation to change job features is not completely new. It is acknowledged in Ilgen and Hollenbeck's (1991) job role differentiation theory, and proposed as a socialization strategy that proactive recruits use (i.e., job change negotiation; Jones, 1986; Ashford & Black, 1996). I-deals differ, however, referring not to individual behavior, but to personally sought and organizationally authorized *conditions*. They are joint agreements reflecting both employer and worker interests and influence.

Tasks i-deals constitute a middle path between top-down work redesign and a single worker's private efforts to craft a job. Workers are limited in the extent they can substantially change their requisite duties without authorization. If approval is required to do so, employees must influence their employer.

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Task i-deals can be used to make work duties and demands more congruent with personal needs or goals, thus improving person–job fit (P-J fit; Edwards, 1991; Kulik, Oldham, & Hackman, 1987). Individual differences and variety in i-deals notwithstanding, we suggest that general motives for workers to negotiate for them are to (a) satisfy basic work-related and career needs for competence, autonomy, and relatedness; and (b) promote personal well-being and health (e.g., Bandura, 1997; Grant, 2007; Grant & Parker, in press; Ryan & Deci, 2000; Sauter, Hurrel, & Cooper, 1989; Wrzesniewski & Dutton, 2001).

Employers and their agents tend to agree to task i-deals that meet their own interests such as retaining a valued worker seeking arrangements not covered by the firm's standard offerings (Rousseau, 2005). Employers incorporating personalized rewards (e.g., personal growth and development) into their human resource practices will find it difficult to provide these effectively without input from individual workers. Engaging in individual negotiations gives employers access to otherwise private information regarding worker preferences and interests, helping them to better target rewards to those workers who value them. Employers also use task i-deals to signal to individuals their special value by granting them unusual autonomy or flexibility. Indeed, reciprocity can be a basis for creating i-deals. Following completion of an important project or an extraordinarily positive performance review, employers can be particularly responsive to employee requests (Rousseau, 2005). Strategic needs also motivate task i-deals, as in the case when a firm expands its sources of labor to include workers differing from those served by its current established human resource practices (e.g., female lawyers in law firms). Human resource practices oftentimes evolve through exceptions made to standard arrangements. As a flexible response to changing needs, task i-deals can establish new precedents that ultimately form the basis for broader changes in job design.

The three contrasted job design approaches differ in their theoretical and practical implications. Each approach is suited to particular contexts and serves different goals. As a middle ground between top-down interventions and bottom-up job crafting, task i-deals offer a practical alternative and supplement to more recognized forms of job redesign. To provide evidence regarding individual negotiation as a way for customizing job content, we next develop and test some basic theory on task i-deals.

Hypotheses

LMX: The relational basis of task i-deals

Task i-deals are authorized by the employer or its agents (e.g., higher levels managers, human resources), typically the immediate supervisor (Rousseau, 2005; Hornung et al., in press). In this context, leader–member exchange (LMX) provides a relational basis within which i-deals can be created (Rousseau, 2005). LMX describes the degree of social exchange in the supervisor–employee relationship (e.g., Graen & Scandura, 1987; Wayne, Shore, & Liden, 1997). It indicates an employee's reputation and social standing as a member of the supervisor's in-group (Gerstner & Day, 1997; Hochwarter, Ferris, Zinko, James, & Platt, 2007). Workers who are especially valued and trusted by their supervisors have more flexible or expandable zones of acceptance. High LMX relationships imply greater interpersonal support, making requests for individual arrangements more likely to be sought out and granted (Rousseau, Ho, & Greenberg, 2006). Task i-deals thus will be facilitated by supervisor relationship quality.

H1: Employee perceptions of LMX will be positively related to the extent of task i-deals.

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Work characteristics: Redesign through task i-deals

Through task i-deals, employee and employer articulate and re-interpret the zone of acceptance surrounding an employee's work activities. For workers, task i-deals offer a way to improve P-J fit, thus enhancing personal need satisfaction and well-being. Three established dimensions along which jobs can vary are: (a) complexity, (b) control, and (c) stressors (e.g., Büssing & Glaser, 2002; Frese & Zapf, 1991; Sauter et al., 1989). Job characteristic models typically include forms of complexity and control to describe conditions that stimulate intrinsic motivation, learning, and personal growth, thus supporting worker well-being, mental health, and performance (e.g., autonomy and skill variety; Hackman & Oldham, 1975, 1980; decision authority and skill discretion; Karasek, 1979; Karasek & Thorell, 1990; method control and problem-solving demand; Jackson, Wall, Martin, & Davids, 1993). Work stressors are theoretically distinct from complexity (e.g., Frese, Kring, Soose, & Zempel, 1996); they need not be inherent in the task (intrinsic), but refer to unfavorable (extrinsic) conditions that interfere with the individual's performance and exercise of control (e.g., unclear objectives, not enough time), threatening psycho-physical well-being and health (Frese & Zapf, 1991; Podsakoff, LePine, & LePine, 2007). The consequences associated with task i-deals derive from their role as an attempt to make an individual's work more personally rewarding—that is, more intrinsically motivating, personally meaningful, and less aversive. Thus, negotiating task i-deals is likely to affect all three key dimensions of work—complexity, control, and stressors.

Expanding complexity and control at work

Intrinsically motivating tasks comprise activating demands *and* supportive resources that enable autonomous regulation (e.g., motivating goals and freedom, how to achieve them; Frese & Zapf, 1991; Glaser & Hornung, 2007; Hacker, 2003). Broadly defined as the number of elements to be considered in a given task, complexity requires development and use of different work-related skills, exercising and expanding cognitive, social, and practical abilities (Büssing & Glaser, 2002; Frese, Garst, & Fay, 2007; Hacker, 2003). The most intensively researched job characteristic, autonomy or control, refers to opportunities for decision-making and personal discretion (e.g., Jackson et al., 1993; Sauter et al., 1989). A form of active influence, i-deals are likely to be motivated by individual predispositions for control, self-efficacy, and positive social interaction (e.g., Bandura, 1997; Ryan & Deci, 2000; Wrzesniewski & Dutton, 2001). As a means to increase P-J fit by making work more aligned with personal aspirations for self-determination and growth, task i-deals are expected to enhance the focal individual's complexity and control at work.

H2: The extent of task i-deals will be positively related to complexity (H2a) and control at work (H2b).

Reducing work stressors

Work stressors are aversive characteristics of jobs (i.e., 'regulation hindrances,' Frese & Zapf, 1991). Unlike complexity in the task itself, stressors obstruct or complicate job performance, potentially overtaxing the individual worker (e.g., Büssing & Glaser, 2000, 2002; Oesterreich & Volpert, 1986). A recently introduced meta-analytic taxonomy of challenge stressors and hindrance stressors (Podsakoff et al., 2007) supports the distinction between predominantly positive (complexity) and negative job demands (stressors). Work stressors indicate discrepancies between working conditions and an individual's capacity to effectively respond to related impediments. Such person–environment mismatches will result in psychological strain and eventually impair mental and physical health (e.g., Podsakoff et al., 2007; Stansfeld & Candy, 2006). Negotiating task i-deals to reduce stressors is a form of active coping with detrimental job features. It can increase P-J fit by reducing incongruence between environmental conditions and an individual's well-being.

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H3: The extent of task i-deals will be negatively related to work stressors.

Positive work outcomes: Initiative and engagement

I-deals are intended to serve both worker needs and employer interests (Rousseau et al., 2006). Task i-deals hold the promise of creating individually optimal conditions for sustainable work motivation, performance, and well-being. Used to increase P-J fit by customizing work features, task i-deals are expected to positively affect personal initiative (PI) and work engagement (WE). Both PI and WE are valued by organizations and individuals. PI is foremost a performance concept and secondly an indicator of active mental health (Frese & Fay, 2001; Parker et al., 2003). WE is an active state of work-related subjective well-being, and positively related to performance (Salanova, Agut, & Peiro, 2005). Our choice of PI and WE as positive work outcomes balances the benefits to employee and employer from optimizing P-J fit.

Personal initiative

Initiative is defined as the future-oriented, persistent pursuit of individual and organizational goals (Frese & Fay, 2001). PI is a form of proactive performance, especially relevant in settings with changing or uncertain job roles (Crant, 2000; Griffin et al., 2007). Complexity and control at work are known to enhance PI by aiding development of individual self-efficacy and active control orientations (e.g., Frese et al., 1996, 2007). If task i-deals increase P-J fit by making job features more intrinsically motivating and worker controlled (i.e., self-regulated), they are expected to increase PI via their positive effects on work characteristics.

H4: Complexity and control at work will be positively related to PI (H4a) and mediate positive indirect effects of task i-deals on PI (H4b).

Work engagement

Engagement is a work-related state of subjective well-being (Schaufeli & Bakker, 2003, 2004). It is effectively the opposite of burnout, characterized by vigor, dedication, absorption—antipodes to burnout-symptoms of exhaustion, cynicism, and inefficacy. Engaged workers display high energy, identify strongly with their jobs, and experience flow-like states at work. Whether workers develop symptoms of burnout or engagement is at least partly a function of job design. Both direct and interacting influences on WE exist across a broad range of job characteristics (Demerouti, Bakker, Nachreiner, & Schaufeli, 2001; Schaufeli & Bakker, 2004; Van der Doef & Maes, 1999). Most consistent are the positive effects of job resources (e.g., autonomy, skill variety) and negative effects of stressful demands (e.g., workload, time pressure, role conflicts). Accordingly, complexity and control are expected to be positively and stressors negatively related to WE (e.g., Büssing & Glaser, 2000; Van der Doef & Maes, 1999). If task i-deals are used to increase fit between personal needs or goals and their fulfillment during work activities (e.g., self-efficacy, positive self-image), they are likely to enhance WE. By making tasks more intrinsically motivating and less stressful, task i-deals are expected to enhance engagement through positive effects on work characteristics.

H5: Complexity and control at work will be positively (H5a) and work stressors negatively (H5b) related to WE; complexity, control, and stressors will mediate positive indirect effects of task i-deals on WE (H5c).

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Method

Study 1 examined relationships between LMX, task i-deals, work characteristics (complexity and control), and PI among hospital workers in the United States, testing hypotheses H1, H2, and H4. Study 2 aims to replicate H1 and H2. Using an expanded set of work characteristics (complexity, control, and stressors) and WE as an outcome, it further tests H3 and H5. Study 2's sample of German hospital physicians examines the generalizability of Study 1's findings to a different occupational and cultural context.

Study 1's setting

Study 1 was conducted in a mid-sized general hospital in the United States. Data were collected from all occupational groups (e.g., nurses, therapists, administrative, technical, and support staff) employed in the hospital, except physicians, who were not hospital employees. Of 400 total employees, 207 returned completed surveys. Listwise deletion of missing data led to $N = 189$ (47.3%). Table 2 describes this sample's distribution of gender, age, tenure, part-time status, and job level. Hospital efforts promoting employee participation in quality improvement motivated its work council to support this study (Hornung & Rousseau, 2007). PI was used as an outcome due to its relevance to workplace innovation and employee-initiated improvements.

Study 2's setting

Altogether 292 physicians in two comparable German hospitals were asked to participate in a study of work conditions and mental health. Overall, 159 returned completed surveys. After listwise deletion of missing data, $N = 135$ (46.2%) were included in our analyses. Average age and hospital tenure, frequencies for gender, part-time status, and positions held by doctors are shown in Table 2. Concern for the risks physicians face in terms of mental health (Shanafelt, Sloan, & Habermann, 2003) motivated the hospitals' participation in the study. In consequence, data were gathered on work stressors—and WE was used to measure subjective well-being.

Table 2. Sample descriptions

	Study 1	Study 2
	$N = 189$ hospital employees (U.S.A.)	$N = 135$ hospital doctors (Germany)
Gender	27 (14.3%) male	65 (48.1%) male
Age	41–45 years (median category)	$M = 38.76$ years (SD = 8.35)
Tenure	4–5 years (median category)	$M = 7.78$ years (SD = 6.82)
Part-time	30 (15.9%)	18 (13.3%)
Job level	Education	Position
	9 (4.8%) master's degree	14 (10.4%) chief physician
	32 (16.9%) bachelor degree	24 (17.8%) senior staff physician
	68 (36.0%) associate degree	43 (31.9%) staff physician
	23 (12.2%) registered nurse diploma	52 (38.5%) resident
	53 (28.0%) high school diploma	
	4 (2.1%) missing	2 (1.5%) missing

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Measures

Leader–member exchange (LMX)

The quality of the supervisory relationship was assessed with well-established measures. Study 1 included a 10-item scale ($\alpha = .96$) by Wayne et al. (1997), Study 2 the German version of a 7-item scale ($\alpha = .92$) by Scandura and Graen (1984); both used a 5-point response format (e.g., 1 = ''none/not at all'' to 5 = ''very high/to a very great extent''). A representative item is ''My supervisor would come to my defense if I were 'attacked' by others.''

Task i-deals

Based upon Rousseau and Kim (2006; see: Hornung et al., 2008), participants rated the extent they had *''asked for and successfully negotiated''* personalized conditions in their current job. Study 1 included three items ($\alpha = .70$) using a five-point scale (1 = ''not at all'' to 5 = ''to a very great extent''). Items refer to ''skill development,'' ''performance goals,'' and ''on-the-job activities.'' Study 2's i-deal measures were reformulated based on findings from Study 1, and contained four items ($\alpha = 86$): ''personally challenging work tasks,'' ''special job duties or assignments,'' ''work tasks that suit my personal interest,'' and ''on-the job activities especially suited to me.'' These changes reflect our efforts to focus the scale explicitly on job content, rather than professional development more broadly, making it more consistent with theory on this form of i-deal. Respondents rated the extent they negotiated work conditions different from standard on a six-point scale (1 = ''no special terms'' to 6 = ''very high''). Those endorsing category 1 (''no special terms'') were then asked to specify if they had ''not asked for'' or ''asked for but *not* successfully negotiated'' the item. To use this information, we created an additional dummy-coded variable for *denied task i-deals* in Study 2. Respondents, who had at least once used the ''not negotiated successfully'' category were coded 1, all others were coded 0.

Work characteristics

Three scales were adapted from a German hospital work analysis tool (Tätigkeits- und Arbeitsanalyseverfahren, TAA; Büssing & Glaser, 2000, 2002). Based on action-regulation theory, the instrument assesses (a) demands, (b) resources, and (c) hindrances for self-regulation at work (Frese & Zapf, 1991; Glaser & Hornung, 2007; Hacker, 2003, Oesterreich & Volpert, 1986). Work characteristics can be well measured by self-reports due to high congruence between job incumbents' perceptions and external observations (e.g., Spector, 1992). In Study 1, measures of task demands (i.e., complexity) and resources (i.e., control) were translated through an iterative process by native German and English speakers. Study 2 used the original TAA scales; complexity and control were measured as in Study 1 along with a measure of stressors. All three used five-point scales (1 = ''not at all'' to 5 = ''to a very great extent'').

1. *Complexity.* Complexity refers to the degree tasks allow use of intellectual abilities, require collaboration, and support skill acquisition. Such demands meet needs for self-efficacy, growth, and social interaction. The nine-item scale ($\alpha = .82/.83$ for each study) contained three three-item subscales: (a) *problem solving*—use of intellectual abilities to solve novel problems (three items; $\alpha = .83/.76$; e.g., ''This work requires thinking problems through completely to solve them''); (b) *cooperation*—coordination and collaboration with others (three items; $\alpha = .68/.70$; e.g., ''This work requires close cooperation with coworkers in the unit''); (c) *skill acquisition*—development of professional knowledge, social competencies, and practical skills (three items; $\alpha = 81/.85$; e.g., ''This work offers opportunity to acquire additional theoretical knowledge'').
2. *Control*. Control refers to the degree work allows autonomous decision-making and personal discretion. Our measure reflects the concept of activity latitudes, distinguishing between various

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forms of control in task performance (e.g., Büssing & Glaser, 2002). It is broader than common measures of autonomy, consistent with efforts to refine theory and measurement of job control (e.g., method and timing control; Jackson et al., 1993). The scale contains six items ($\alpha = .90/.91$) based upon three facets of two items each: (a) *goal control*—authority to choose tasks and set work goals (two items; $\alpha = .79/.89$; e.g., ''This work allows for making decisions on task goals''); (b) *approach control*—personal discretion to use individual approaches and experiment with new ways of doing things (two items; $\alpha = .85/.81$; e.g., ''This work permits using my own ideas''); (c) *execution control*—freedom to determine task timing, sequence, and operations (two items; $\alpha = .76/.86$; e.g., ''This work offers discretion in processing and scheduling'').

3. *Stressors*. Stressors refer to work conditions that obstruct the attainment of task goals (Oesterreich & Volpert, 1986). They can arise out of discrepancies among work goals (e.g., conflicting instructions), as well as between work goals and available means (e.g., information, tools, materials), and time to achieve them (Büssing & Glaser, 2002). Study 2 scales were selected based on theory and research regarding job stressors (e.g., role conflict, ambiguity, and overload; Rizzo, House, & Lirtzman, 1970; Podsakoff et al., 2007). Altogether nine items ($\alpha = .86$) were measured, three for each of three subscales: (a) *goal conflict*—incompatible demands or expectations regarding work outcomes (three items; $\alpha = .76$; e.g., ''Work assignments are frequently incompatible with each other''); (b) *ambiguity*—lack of information hampering task performance (three items; $\alpha = .82$; e.g., ''Information needed to do the work is frequently not available''); and (c) *overload*—workload exceeding time available (three items; $\alpha = .88$; e.g., ''Even in a constant hurry, the amount of work is frequently too high to complete'').

Personal initiative (PI)

Study 1's outcome, PI, was measured with a seven-item ($\alpha = .87$) scale (Frese, Fay, Hilburger, Leng, & Tag, 1997). Sample items are: ''I take initiative immediately even when others don't'' and ''Usually, I do more than what I am asked to do.'' It uses a five-point scale (1 = ''not at all'' to 5 = ''to a very great extent'').

Work engagement (WE)

Study 2's outcome was measured using the German nine-item ($\alpha = .87$) short version of the Utrecht work engagement scale (Schaufeli & Bakker, 2003). Participants rated how often they experienced positive work-related states, using a seven-point scale from ''never'' to ''always/every day''. Each of the three facets had three items: (a) *vigor* (e.g., ''At my job, I feel strong and vigorous''; $\alpha = .77$), (b) *dedication* (e.g., ''I am enthusiastic about my job''; $\alpha = .84$), and (c) *absorption* (e.g., ''I feel happy when I work intensely''; $\alpha = .81$).

Control variables

In both studies, dichotomous variables operationalized gender (0 = female, 1 = male) and part-time status (0 = full-time, 1 = part-time). In Study 1, age was measured with 11 categories from ''below 21'' (1) to ''over 65'' (11), and organizational tenure with 10 categories from ''a year or less'' (1) to ''more than 30 years'' (10). In Study 2, age and tenure were reported in years. Context-specific measures assessed job level. Study 1 used five categories on education from ''high school diploma'' (1) to ''master's degree'' (5). In Study 2, respondents checked their position's title and rank, from ''resident'' (1) to ''chief physician'' (4).

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Results

Analyses are based on confirmatory factor analysis (CFA) and structural equation modeling (SEM) using AMOS 16.0 (Byrne, 2001). We examined accepted goodness-of-fit indices and applied conventional cut-offs (e.g., Byrne, 2001; Brown, 2006; Kline, 1998): Relative χ^2 (χ^2/df) < 2.0 indicates good, < 3.0 acceptable fit; incremental fit indices (incremental fit index, IFI; Tucker Lewis index, TLI; comparative fit index; CFI) should be $> .90$; root mean square error of approximation (RMSEA) $< .05$ indicates good, $< .08$ adequate, $> .10$ unacceptable fit. Model comparisons used χ^2 statistics.

With the exception of task i-deals, items were aggregated into parceled indicators to improve the ratio of estimated model parameters to sample size (Bandalos & Finney, 2001). Descriptive statistics and correlations of higher-order factors are shown in Tables 3 and 4. In both studies, the overall extent of task i-deals was low (Study 1: $M = 2.11$ [1–5], SD = 0.99; Study 2: $M = 2.08$ [1–6], SD = 1.38). In Study 2, 25 respondents (18.5%) reported at least one (and up to four) instances of failed negotiation.

Table 3. Descriptive statistics and correlations in Study 1

	M	*SD*	1	2	3	4	5	6	7	8	9
1. Gender	—	—									
2. Age	—	—	−.09								
3. Tenure	—	—	.03	.50**							
4. Job level	—	—	−.07	.03	−.06						
5. Part-time	—	—	−.18*	−.02	−.14	.06					
6. LMX	3.58	0.99	−.14	−.01	−.13	.09	.10				
7. Task i-deals	2.11	0.99	.01	−.09	−.01	−.04	−.01	.18*			
8. Complexity	3.95	0.67	.07	.05	−.05	.21**	.15*	.14	.15*		
9. Control	3.71	0.84	.02	.12	.04	.16*	.07	.01	.17*	.40**	
10. Personal initiative	3.83	0.63	−.11	.09	−.05	.22**	−.09	.28**	.09	.29**	.25**

Notes: $N = 189$ hospital employees. M = mean; SD = standard deviation; descriptive statistics of control in Table 2.
*$p < .05$; **$p < .01$.

Table 4. Descriptive statistics and correlations in Study 2

	M	*SD*	1	2	3	4	5	6	7	8	9	10	11
1. Gender	—	—											
2. Age	—	—	.23**										
3. Tenure	—	—	.03	.50**									
4. Job level	—	—	−.07	.03	−.06								
5. Part-time	—	—	−.18*	−.02	−.14	.06							
6. LMX	3.37	0.82	.03	−.25**	−.18*	−.05	−.03						
7. Task i-deals	2.08	1.38	−.08	.22*	.26**	.30**	.18*	.34**					
8. Denied task i-deals	—	—	.11	.03	−.07	−.04	.08	−.25**	−.22*				
9. Complexity	4.05	0.61	−.03	−.16	.00	.05	−.25**	.23**	.20*	−.02			
10. Control	2.94	0.80	.15	.46**	.35**	.46**	−.08	.08	.39**	−.22*	.11		
11. Stressors	3.43	0.72	−.07	−.26**	−.18*	−.16	−.16	−.25**	−.16	.22*	.12	−.39**	
12. Work engagement	4.91	1.00	.02	.12	.09	.22*	−.05	.25**	.33**	−.15	.36**	.38**	−.26**

Notes: $N = 135$ hospital doctors. M = mean; SD = standard deviation; descriptive statistics of control in Table 2.
*$p < .05$; **$p < .01$.

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Scale analyses and parceling procedure

Work characteristics

In a first step, item-level measurement models of work characteristics were tested. Latent factors for problem solving, cooperation, and skill acquisition were each predicted by the respective three items. Control was modeled as one latent factor, predicted by six items. The three two-item dimensions of control were modeled by correlating measurement errors for each pair of items (Brown, 2006). Study 2 includes the additional nine items and three factors for stressors. Theoretically valid four- and seven-factor measurement models were acceptable and superior to general one-factor models (Table 5).

Parcels were created by combining items according to scale structure (Hall, Snell, & Foust, 1999; Bandalos & Finney, 2001). First-order latent variables for problem solving, cooperation, and skill acquisition were transformed into manifest indicators for a second-order factor of complexity. Pairs of interrelated items for goal control, approach control, and execution control were combined into three parcels predicting control. In Study 2, a second-order factor for stressors was based on scale parcels for goal conflict, ambiguity, and overload. Parceled two- and three-factor measurement models were superior to general factor solutions and had overall acceptable model fit (Table 5). In Study 1, a high RMSEA required applying the most tolerant cut-off for this indicator. In both studies, Cronbach's α was moderate for the complexity parcels ($\alpha = .64/.66$), but satisfactory for all items subsumed under this factor ($\alpha = .82/.83$).

Table 5. Measurement of work characteristics—fit indices

	χ^2	*df*	χ^2/df	IFI	TLI	CFI	RMSEA
Study 1							
1 factor—15 items	563.07**	87	6.47	.66	.51	.65	.171
4 factors—15 items (Table 6—items)	138.49**	81	1.71	.96	.94	.96	.061
1 factor—6 parcels	81.31**	9	9.03	.81	.68	.81	.207
2 factors—6 parcels (Table 6—parcels)	22.38**	8	2.80	.96	.93	.96	.098
Study 2							
1 factor—24 items	1106.29**	249	4.44	.49	.42	.48	.160
7 factors—24 items (Table 6—items)	356.14**	228	1.56	.92	.91	.92	.065
1 factor—9 parcels	163.89**	27	6.07	.64	.51	.63	.195
3 factors—9 parcels (Table 6—parcels)	41.18*	24	1.72	.96	.93	.95	.073
2 factors—9 parcels[a]	104.82**	26	4.03	.80	.71	.79	.150
2 factors—9 parcels[a]	98.30**	26	3.78	.81	.73	.81	.144
2 factors—9 parcels[a]	108.28**	26	4.16	.79	.70	.78	.154
Two-group analysis							
4 factors—15 items—unconstrained[b]	273.20**	162	1.69	.95	.93	.95	.046
4 factors—15 items—invariance[c]	311.64**	179	1.74	.95	.92	.94	.048
4 factors—15 items—partial invariance[d]	292.28**	177	1.65	.95	.93	.95	.045
2 factors—6 parcels—unconstrained[b]	43.45**	16	2.72	.96	.92	.95	.073
2 factors—6 parcels—invariance[e]	52.88**	23	2.30	.95	.94	.95	.064

Notes: $N = 189/135$. χ^2 = chi-square discrepancy; df = degrees of freedom; χ^2/df = relative chi-square; IFI = incremental fit index; TLI = Tucker Lewis index; CFI = comparative fit index; RMSEA = root mean square error of approximation.
[a]Models combined into one factor: (a) complexity/stressors, (b) complexity/control, and (c) control/stressors.
[b]Unconstrained: Estimated freely for both samples, baseline for comparisons.
[c]Invariance: Equality constraints on all factor loadings and covariances reduced model fit ($\Delta\chi^2(17) = 38.44$, $p < .01$).
[d]Partial invariance: After removing equality constraints from one factor loading (approach control item 2) and one covariance (control—problem solving), fit did not differ significantly from the unconstrained baseline model ($\Delta\chi^2(15) = 19.08$, $p > .05$).
[e]Unconstrained and invariance model (equal factor loadings, variances, and covariance) did not differ significantly ($\Delta\chi^2(15) = 9.43$, $p > .05$). $^{*}p < .05$; $^{**}p < .01$.

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Internal consistencies and factor loadings of items and parcels are provided in Table 6. Skill acquisition was the dominant predictor of complexity ($\beta = .84/.71, p < .001$), whereas problem solving ($\beta = .51/.65, p < .001$) and cooperation ($\beta = .55/.55, p < .001$) were weaker. In study 2, stressors were predicted most strongly by goal conflict ($\beta = .90$, $p < .001$) with weaker loadings from ambiguity ($\beta = .57$, $p < .001$) and overload ($\beta = .61$, $p < .001$). To test the empirical distinctness of complexity, control, and stressors in Study 2, three two-factor models systematically combined parcels of each dimension under one factor, producing unacceptable fit.

Table 6. Measurement of work characteristics—factor loadings and consistencies

	Items		Parcels	
	First-order β [α]		Second-order β [α]	
	Study 1	Study 2	Study 1	Study 2
1. Complexity (→ 2nd-order latent)	[.82]	[.83]	[.64]	[.66]
(a) Problem solving (1st-order latent → parcel)	[.83]	[.76]	.51	.65
— finding solutions to novel problems	.76	.68	—	—
— weighing up different ways to solve tasks	.71	.79	—	—
— thinking problems through completely	.92	.70	—	—
(b) Cooperation (1st-order latent → parcel)	[.68]	[.70]	.55	.55
— co–workers in the unit	.75	.72	—	—
— superiors	.73	.56	—	—
— colleagues from other units	.55	.76	—	—
(c) Skill acquisition (1st-order latent → parcel)	[.81]	[.85]	.84	.71
— theoretical knowledge	.79	.83	—	—
— social skills	.72	.83	—	—
— practical skills	.79	.75	—	—
2. Control (1st-order latent → 2nd-order latent)	[.90]	[.91]	[.88]	[.86]
(a) Goal control (substructure → parcel)	[.79]	[.89]	.87	.90
— deciding, which tasks to pursue	.70	.88	—	—
— decisions on task goals	.87	.84	—	—
(b) Approach control (substructure → parcel)	[.85]	[.81]	.83	.76
— using own ideas	.86	.72	—	—
— being creative	.75	.67	—	—
(b) Execution control (substructure → parcel)	[.76]	[.86]	—	—
— discretion in how to do work	.69	.76	.76	.81
— discretion in processing	.66	.75	—	—
3. Stressors (→ 2nd-order latent)	—	[.86]	—	[.72]
(a) Goal conflict (1st-order latent → parcel)	—	[.76]	—	.90
— incompatible work assignments	—	.86	—	—
— conflicting quantity and quality goals	—	.76	—	—
— counterproductive instructions	—	.57	—	—
(b) Ambiguity (1st-order latent → parcel)	—	[.82]	—	.57
— needed information not available	—	.86	—	—
— unclear how to obtain information	—	.73	—	—
— problems with information transfer	—	.75	—	—
(c) Overload (1st-order latent → parcel)	—	[.88]	—	.61
— amount of work is too high	—	.86	—	—
— too much to do at once	—	.90	—	—
— time pressure due to short-term deadlines	—	.76	—	—
	—		—	—

Notes: $N = 189/135$; β = standardized CFA loadings; all $p < .001$; the first two number columns refer to the item-level measurement model, the last two to the parceled solution; transformations indicated with construct labels; item content partly abridged; values in brackets [α] are Cronbach's alpha coefficients for items or parcels subsumed under one scale or higher-order factor.

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To test for invariance between the two studies, the comparable part of the measurement model was re-estimated in two-group analyses. On the item-level, imposing equality constraints across the two samples for all factor loadings and covariances significantly reduced fit ($\Delta\chi^2$ (17) = 38.44, $p < .01$). Only partial invariance could be established by removing equality constraints of one factor loading (approach control item 2) and one factor covariance (control—problem solving; $\Delta\chi^2(15) = 19.08$, $p > .05$). For the parceled solution, invariance could be established to the level of equal factor loadings, factor variances and their covariance.

Task i-deals, LMX, and PI/WE

Measurement models for task i-deals, LMX, and PI or WE were analyzed in the next step. In Study 1, the theoretical three-factor model outperformed a one-factor model and two two-factor models, subsuming task i-deals under one factor with LMX or PI. Model fit was suboptimal, but improved to an acceptable level by allowing item error terms within the LMX and PI factor to correlate (Table 7). The modeled pattern corresponds with the procedure used for combining items into parcels. For one-dimensional scales, it is arbitrary how parcels are formed (Hall et al., 1999). Correlations were added among LMX items (a) 1, 4, 7, 19; (b) 2, 5, 8; and (c) 3, 6, 9; and PI items (a) 1, 4, 7; (b) 2, 5; and (c) 3, 6. Next, these groups of items were aggregated into parcels and the measurement model re-estimated, demonstrating close fit. Similar procedures were used in Study 2. Task i-deals were empirically distinct

Table 7. Measurement of task i-deals, LMX, and PI/WE—fit indices

	χ^2	df	χ^2/df	IFI	TLI	CFI	RMSEA
Task i-deals, LMX, PI/WE							
Study 1							
1 factor—20 items	1049.68**	170	6.18	.67	.59	.67	.166
2 factors—20 items[a]	560.22**	169	3.32	.86	.82	.85	.111
2 factors—20 items[a]	567.22**	169	3.36	.85	.81	.85	.111
3 factors—20 items	445.16**	167	2.67	.89	.87	.90	.094
3 factors—20 items—substructure[b]	294.31**	151	1.95	.95	.93	.95	.071
3 factors—3 items, 6 parcels	45.18	32	1.41	.99	.98	.99	.055
Study 2							
1 factor—20 items	1017.44**	170	5.99	.48	.42	.48	.193
2 factors—20 items[a]	470.79**	169	2.79	.82	.79	.82	.115
2 factors—20 items[a]	470.10**	169	2.78	.82	.79	.82	.115
3 factors—20 items	244.10**	167	1.42	.95	.95	.95	.059
3 factors—20 items—substructure[c]	212.76**	158	1.35	.97	.96	.97	.051
3 factors—4 items, 6 parcels	34.57	24	1.44	.99	.98	.99	.048
Integration with work characteristics							
Study 1							
5 factors—3 items, 12 parcels (Table 8)	120.76**	80	1.51	.97	.97	.97	.052
Unmeasured common method factor[d]	86.36*	65	1.33	.99	.98	.99	.042
Study 2							
6 factors—4 items, 15 parcels (Table 8)	166.03*	137	1.21	.98	.97	.98	.040
Unmeasured common method factor[e]	132.21	118	1.12	.99	.99	.99	.030

Notes: $N = 189/135$. χ^2 = chi-square discrepancy; df = degrees of freedom; χ^2/df = relative chi-square; IFI = incremental fit index; TLI = Tucker Lewis index; CFI = comparative fit index; RMSEA = root mean square error of approximation.
[a]Models combined into one factor: (a) task i-deals and LMX, (b) task i-deals and PI/WE.
[b]Correlated error terms of PI and LMX parcel items.
[c]Correlated error terms of vigor, dedication, and absorption items.
[d]Improvement in chi-square discrepancy ($\Delta\chi^2(15) = 34.40$, $p < .01$).
[e]Improvement in chi-square discrepancy ($\Delta\chi^2(19) = 33.82$, $p < .05$).
*$p < .05$; **$p < .01$.

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from LMX and WE, and only the three-factor model had good fit. Fit was further improved by modeling the scale structure of WE through error correlations among items on (a) vigor, (b) dedication, and (c) absorption. Subsequently, three parcels were formed based on these dimensions. For LMX three parcels combined items (a) 1, 4, 7; (b) 2, 5; and (c) 3, 6. Fit of the resulting model was adequate.

Final measurement models

Finally, for each study, parceled solutions of all scales were combined into one measurement model. Goodness-of fit indices fully supported these final measurement models (Study 1: $\chi^2(80) = 120.76$, $p < .01$; $\chi^2/df = 1.51$; IFI = .97; TLI = .97; CFI = .97; RMSEA = .052; Study 2: $\chi^2(137) = 166.03$, $p < .01$; $\chi^2/df = 1.21$; IFI = .98; TLI = .97; CFI = .98; RMSEA = .040). Table 8 displays factor loadings and internal consistencies. Measurement of LMX, PI, and WE was unproblematic with high loadings and good consistencies on the item- and parcel level. In Study 1, the loading of one task i-deals item was low (''on-the-job activities''; $\beta = .47$, $p < .001$). In Study 2, the same item had a more substantial loading ($\beta = .74$, $p < .001$), yet remained among the weaker indicators. Moderate loadings in second-order work characteristics factors have been pointed out. For an assessment of common method variance, an unmeasured latent factor loading on all manifest indicators was added (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). This improved model fit in Study 1 ($\Delta\chi^2(15) = 34.40$, $p < .01$) and—to a lesser degree—also in Study 2 ($\Delta\chi^2(19) = 33.82$, $p < .05$), suggesting that common methods variance is a potential source of bias and should be addressed in further analyses.

Table 8. Final measurement models—factor loadings and consistencies

	Study 1	Study 2
LMX (10/7 items)	[.96/.96]	[.92/.93]
Parcel 1 (4/3 items)	.91	.95
Parcel 2 (3/2 items)	.94	.89
Parcel 3 (3/2 items)	.98	.87
Task i-deals (3/4 items)	[.70]	[.86]
Skill development/Challenging task	.94	.87
Performance goals/Interesting tasks	.62	.80
On-the job activities	.47	.74
Special duties or assignments	—	.72
Complexity (9 items)	[.82/.64]	[.83/.66]
Problem solving (3 items)	.56	.65
Cooperation (3 items)	.58	.60
Skill acquisition (3 items)	.78	.67
Control (6 items)	[.90/.88]	[.91/.86]
Goal control (2 items)	.87	.89
Approach control (2 items)	.83	.77
Execution control (2 items)	.76	.80
Stressors (9 items)	—	[.86/.72]
Goal conflict (3 items)	—	.89
Ambiguity (3 items)	—	.59
Overload (3 items)	—	.61
PI/WE (7/9 items)	[.87/.89]	[.92/.91]
Parcel 1/Vigor (3/3 items)	.91	.85
Parcel 2/Dedication (2/3 items)	.82	.92
Parcel 3/Absorption (2/3 items)	.85	.88

Notes: $N = 189/135$; β = standardized CFA loadings; all $p < .001$; values in brackets are Cronbach's alpha coefficients for items/parcels subsumed under one factor [α items/α parcels]; for fit indices see Table 7.

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Specification of structural models

Established CFA models were transformed into structural models to test our hypotheses. Paths were specified from LMX to task i-deals (H1); from task i-deals to work characteristics (H2a: Complexity; H2b: Control; in Study 2 also H3: Stressors); and from all work characteristics to the study's respective outcome of PI (H4) or WE (H5). This first structural model fit adequately in both studies (Table 9). Next, we added controls for gender, tenure, part-time, and job level on task i-deals. In Study 1, additional significant paths were added from job level to complexity and control. In Study 2, the dichotomous indicator for denied task i-deals was entered as another control. We tested all six possible direct effects of job level and denied task i-deals on work characteristics. The resultant three significant paths were retained in the structural model. Controls further improved fit relative to degrees of freedom in both studies.

Results in Study 1

Study 1's structural model (Figure 1) displayed acceptable fit ($\chi^2(135) = 242.87$, $p < .01$; $\chi^2/df = 1.80$; IFI = .94; TLI = .91; CFI = .93; RMSEA = .065). Per H1, LMX related positively to task i-deals ($\beta = .23$, $p < .05$). H2 was supported by positive effects of task i-deals on both complexity (H2a: $\beta = .26$, $p < .05$) and control (H2b: $\beta = .18$, $p < .05$). Per H4a, both work characteristics were also positively related to PI (complexity: $\beta = .30$, $p < .01$; control: $\beta = .16$, $p < .05$). Sobel-tests assessed indirect effects[1] using recommended significance adjustments (i.e., critical z'-value for $p' < .05$ is .097 and for $p' < .01$ is 1.10; MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). Results support H4b: Both complexity ($\beta = .08$, $z = 1.96$, $p' < .01$) and control ($\beta = .03$, $z = 1.49$, $p' < .01$) mediated effects of task i-deals on PI. Job level related positively to both complexity ($\beta = .27$, $p < .01$) and control ($\beta = .19$, $p < .05$). Task i-deals mediated LMX's effect on these work characteristics (complexity: $\beta = .06$, $z = 1.74$, $p' < .01$; control: $\beta = .04$, $z = 1.55$, $p' < .01$).

Table 9. Fit indices for structural models

	χ^2	df	χ^2/df	IFI	TLI	CFI	RMSEA
Study 1							
Measurement model	120.76**	80	1.51	.97	.97	.97	.052
Structural model	179.89**	85	2.12	94	.93	.94	.077
Including controls (Figure 1)	242.87**	135	1.80	94	.91	.93	.065
Study 2							
Measurement model	166.03*	137	1.21	.98	.97	.98	.040
Structural model	206.59**	145	1.43	.96	.95	.95	.056
Including controls (Figure 2)	298.72**	227	1.32	.95	.94	.95	.049

Notes: $N = 189/135$. χ^2 = chi-square discrepancy; df = degrees of freedom; χ^2/df = relative chi-square; IFI = incremental fit index; TLI = Tucker Lewis index; CFI = comparative fit index; RMSEA = root mean square error of approximation.
*$p < .05$; **$p < .01$.

[1]According to Kenny, Kashy, and Bolger (1998), only two of the four steps originally proposed by Baron and Kenny (1986) are essential for establishing mediation: showing that (a) the *initial* variable is correlated with the *mediator*, and (b) the *mediator* affects the *outcome*. The implied indirect effect of the initial variable on the outcome can then be tested for significance using Sobel-tests or alternative procedures such as bootstrapping. Although there is an ongoing methodological debate on the analysis of indirect and mediated effects, most researchers support this position (e.g., MacKinnon, Fairchild, & Fritz, 2007).

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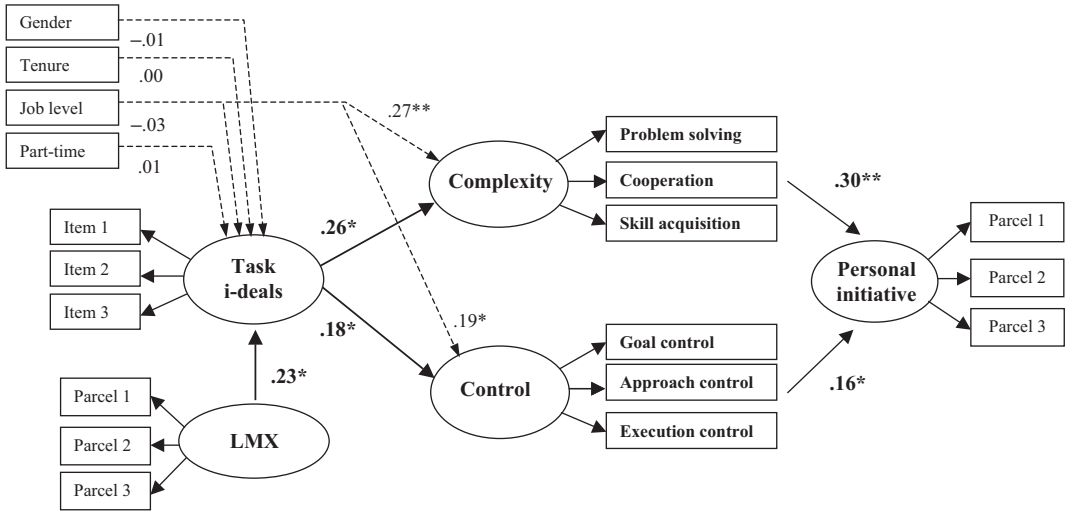

Figure 1. Structural model in Study 1. *Notes*: $N = 189$; $^{**}p < .01$, $^{*}p < .05$; standardized regression weights; correlations between independent variables not shown; fit indices are provided in Table 9

Results in Study 2

Study 2's structural model showed good fit (Figure 2; $\chi^2(227) = 298.72$, $p < .01$; $\chi^2/\text{df} = 1.32$; IFI = .95; TLI = .94; CFI = .95; RMSEA = 049). Validating H1 and H2, LMX was positively related to task i-deals ($\beta = .42$, $p < .01$), which in turn was positively related to both Complexity (H2a: $\beta = .30$,

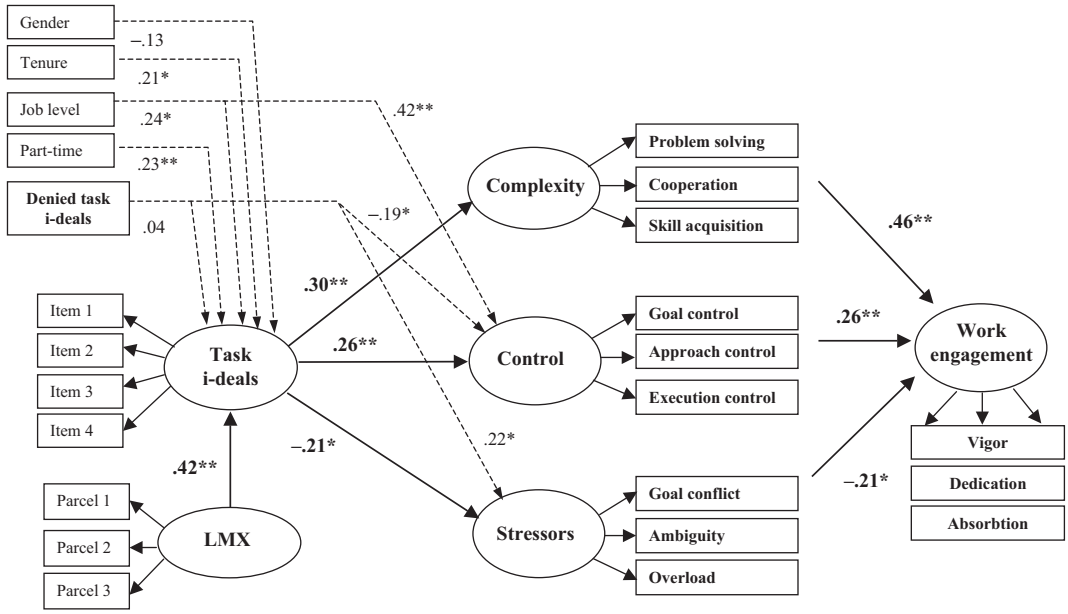

Figure 2. Structural model Study 2. *Notes:* $N = 135$; $^{**}p < .01$, $^{*}p < .05$; standardized regression weights; correlations between independent variables not shown; fit indices are provided in Table 9

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Table 10. Controlling for common method variance in structural models

	Uncontrolled		Controlled										
	β	[B, SE]	β	[B, SE]	t	$\Delta\chi^2$	Δdf	χ^2	df	χ^2/df	IFI	TLI	CFI	RMSEA
Structural model Study 1 (Figure 1)		Baseline						242.87^{**}	135	1.80	.94	.91	.93	.065
Step 1: LMX → Task i-deals	$.23^{*}$	[.14, .06]	$.25^{*}$	[.15, .06]	0.12	−9.24	4[a]	233.63^{**}	131	1.78	.94	.91	.93	.065
Step 2a: Task i-deals → Complexity	$.26^{*}$	[.26, .10]	$.31^{*}$	[.26, .12]	∼ 0	-43.64^{**}	9	199.23^{**}	126	1.58	.96	.93	.96	.056
Step 2b: Task i-deals → Control	$.18^{*}$	[.27, .13]	$.16^{***}$	[.21, .12]	0.34									
Step 3a: Complexity → PI	$.30^{**}$	[.33, .11]	$.42^{**}$	[.55, .19]	1.00	-44.89^{**}	9	197.98^{**}	126	1.57	.96	.93	.96	.055
Step 3b: Control → PI	$.16^{*}$	[.12, .06]	$.15^{\dagger}$	[.13, .07]	0.11									
Structural model Study 2 (Figure 2)		Baseline						298.72^{**}	227	1.32	.95	.94	.95	.049
Step 1: LMX → Task i-deals	$.41^{**}$	[.90, .19]	$.43^{**}$	[.67, .19]	0.86	-24.99^{**}	6[b]	273.73^{**}	221	1.24	.97	.95	.96	.042
Step 2a: Task i-deals → Complexity	$.30^{**}$	[.08, .03]	$.29^{*}$	[.07, .03]	0.24	-23.64^{*}	13	275.08^{**}	214	1.29	.96	.94	.96	.046
Step 2b: Task i-deals → Control	$.26^{**}$	[.13, .04]	$.26^{**}$	[.13, .04]	∼ 0									
Step 2c: Task i-deals → Stressors	$-.21^{*}$	[−.10, .05]	$-.19^{*}$	[−.09, .04]	0.16									
Step 3a: Complexity → WE	$.46^{**}$	[.84, .21]	$.42^{**}$	[.79, .22]	0.16	-35.32^{**}	12	263.40^{*}	215	1.22	.97	.96	.97	.041
Step 3b: Control → WE	$.26^{**}$	[.25, .08]	$.24^{*}$	[.24, .10]	0.08									
Step 3c: Stressors → WE	$-.21^{*}$	[−.20, .09]	$-.26^{\ddagger}$	[−.45, .27]	0.88									

Notes: $N = 189/135$. χ^2 = chi-square discrepancy; df = degrees of freedom; χ^2/df = relative chi-square; IFI = incremental fit index; TLI = Tucker Lewis index; CFI = comparative fit index; RMSEA = root mean square error of approximation; $\Delta\chi^2/\Delta$df = change in chi-square and degrees of freedom between controlled and uncontrolled model; β = standardized regression weights; unstandardized estimates and standard errors are in brackets [B, SE]; uncontrolled parameters refer to structural models (including control variables); controlled parameters refer to results after partialing out an unmeasured common method factor affecting manifest indicators of: LMX and task i-deals in Step 1; LMX and work characteristics in Step 2; and work characteristics and PI or WE in Step 3; t = t-tests comparing (unstandardized) uncontrolled and controlled parameter estimates (df = 376/268 for Study 1/2).
[a]To obtain an admissible solution, error variance of two LMX parcels was fixed to .01.
[b]Error variance of one task i-deal item fixed to .01.
$^{*}p < .05$; $^{**}p < .01$; $^{***}p = .078$; $^{\dagger}p = .060$; $^{\ddagger}p = .094$.

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$p < .01$) and control (H2b: $\beta = .26$, $p < .01$). Supporting H3, task i-deals also related negatively to stressors ($\beta = -.21$, $p < .05$). According to H5a both complexity ($\beta = .46$, $p < .01$) and control ($\beta = .26$, $p < .01$) related positively to WE, whereas per H5b stressors had a negative effect on WE ($\beta = -.21$, $p < .05$). Sobel-tests showed indirect effects of task i-deals on WE, mediated through all three work characteristics (complexity: $\beta = .14$, $z = 2.22$, $p' < .05$; control: $\beta = .07$, $z = 2.25$, $p' < .05$; stressors: $\beta = .07$, $z = 1.49$, $p' < .05$). Findings thus fully support H5c. Task i-deals were related to several controls (job level: $\beta = .24$, $p < .01$; part-time: $\beta = .23$, $p < .01$; tenure: $\beta = .21$, $p < .05$). Denied task i-deals did not relate to the overall extent of successful negotiation ($\beta = .04$, $p > .05$), but had distinctive independent effects on work characteristics, affecting control negatively ($\beta = -.19$, $p < .05$) and stressors positively ($\beta = .22$, $p < .05$). Job level related positively to control ($\beta = .42$, $p < .01$). LMX had indirect effects on all work characteristics (complexity: $\beta = .13$, $z = 2.32$, $p' < .05$; control: $\beta = .11$, $z = 2.68$, $p' < .05$; stressors: $\beta = -.09$, $z = 1.84$, $p' < .05$).

Assessing common method variance

The extent of common method variance was assessed by reexamining structural paths after partialing out an unmeasured latent factor (Podsakoff et al., 2003; Table 10). To reduce estimation problems, this was done in three steps for: (a) LMX and task i-deals (Step 1); LMX and work characteristics (Step 2); and work characteristics and PI or WE (Step 3). Linking common indicators improved model fit in most cases. In the first step, negative estimates required pre-set random error variances (two Heywood cases in Study 1 and one in Study 2 were constrained to a value of .01; Kline, 1998). In Study 1, the weaker paths from task i-deals on control and from control on WE lost significance ($\beta = .16$, $p = .078$ and $\beta = .15$, $p = .060$); the alternative pathway via complexity was strengthened ($\beta = .31$, $p < .05$ and $\beta = .42$, $p < .01$). *T*-tests, however, indicated no differences between uncontrolled and controlled effect sizes.

In Study 2, results remained overall stable, only one path—from stressors to WE—lost significance ($\beta = -.26$, $p = .094$), showing an inflated effect size and standard error estimate. Again, a *t*-test of the difference between the uncontrolled and controlled parameter did not attain significance. To further address this finding, an alternative way of assessing common method variance through manifest marker variables was used (Lindell & Whitney, 2001). First, a latent regression model of stressors and WE was tested, then complexity and control were included as manifest control variables with direct effects on all six indicators. After partialing out the other two work characteristics, the effect of stressors on WE was slightly lower, yet still significant and estimated reliably (uncontrolled: $\beta = -.30$, $p < .01$; $B = -.30$, SE = .10; controlled: $\beta = -.23$, $p < .05$; $B = -.21$, SE = .10). We conclude that, overall, common method variance does not appear to threaten the validity of our results (Spector, 2006).

Discussion

The two studies provide evidence for the existence and functionality of task i-deals in different occupational and cultural contexts. They demonstrate links that task i-deals have to LMX, work characteristics, PI, and WE, supporting their relevance to research on leadership, job design, proactive behavior, and worker well-being. The opportunity to create task i-deals appears to partly depend on the quality of the supervisory relationship, indicative of a worker's bargaining position

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and flexibility in the zone of acceptance attributed by his or her manager (Rousseau et al., 2006). Facilitated by high LMX, workers can negotiate to make their tasks more challenging, self-determined, and less stressful. Intrinsically motivating and healthy job characteristics, in turn, relate to proactive performance and engagement at work.

Results support our theory that task i-deals are a form of worker-initiated redesign to increase P-J fit. I-deals appear to help employees to impact their jobs in ways that can benefit both them and their employer. As a proactive approach to customizing job content, task i-deals are associated with higher worker control, thus providing resources to reduce or actively cope with stressors (e.g., Büssing & Glaser, 2000). The finding that task i-deals relate negatively to stressors, but positively to complexity at work corresponds with the distinction of hindrance and challenge stressors (Podsakoff et al., 2007). Whereas the former tend to be experienced in a negative way, impairing personal health and well-being, the latter contribute to making work experiences more stimulating and developmental. In times of boundaryless careers and lifelong learning requirements, expanding job complexity becomes vital to employee interests in maintaining and increasing employability (Rousseau, 2005). Given the heterogeneous nature of i-deals, the possibility that such arrangements may also be sought out to reduce job complexity should not be completely ruled out (e.g., due to feelings of inadequacy in one's skills or as a form of withdrawal from work). In light of the large body of evidence for positive employee reactions to task complexity, and taking into account the expected lower acceptance of attempts to reduce complexity on the part of the employer's agents, this is a less likely occurrence.

Reports of denied task i-deals accounted for work characteristics beyond other factors measured here. Failed negotiations suggest that work conditions are poorly aligned with personal needs and preferences. Rejected employees experienced work as more stressful and less controllable, features that in turn undermine their well-being. Unsuccessful attempts to increase P-J fit can make existing discrepancies more salient, induce a sense of frustration, and lack of influence, thus evoking a negative evaluation of job characteristics. The only significant correlation between denied task i-deals and other independent variables in Study 2's structural model was a negative association with LMX ($r = -.31$ $p < .01$). Workers with a high-quality supervisory relationship were less likely to be turned down; denied requests appear symptomatic of lower supervisor support. Their aftermath may also include increased supervisor monitoring, thus narrowing a worker's zone of acceptance, limiting his or her opportunities for job crafting.

Study 2 demonstrated the potential impact of structural factors on a worker's bargaining position. German hospitals have strong medical hierarchies (e.g., positions are standardized and by tradition convertible to military ranks). Medical careers require ongoing learning and specialization through on-the-job practice, which is especially important in earlier career phases (e.g., residents need to document specified surgeries and procedures, knowledge of special fields, technical devices, or treatments as advancement criteria). Job level and tenure related positively to task i-deals. Taken together with our findings on LMX, special work arrangements seem to be a matter of bargaining power and social relationships. As such, there is the risk of excluding workers in less advantageous positions (e.g., resident physicians). On the other hand, part-time employees had a greater extent of task i-deals, consistent with earlier findings (Hornung et al., 2008). Plausible explanations are that working non-standard hours offers more flexibility in creating work-ideals (e.g., scheduling the best time to do interesting work) and enable more customized arrangements because jobs are less comparable (e.g., reducing fairness issues among coworkers; Rousseau et al., 2006). Task i-deals may also be sought to offset or prevent the lower quality treatment part-timers often receive (e.g., poorer job content and performance ratings; Hochschild, 1997; Lee, MacDermid, & Buck, 2000; Rousseau, 2005). The importance of job content for professional advancement among physicians is particularly relevant to the last argument. Overall, results for both agreed-upon and unsuccessful negotiations affirm that

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individual bargaining power and needs for control and personal growth are critical for understanding how task i-deals are created and what consequences they yield.

Theoretical implications

Task i-deals differ from other approaches to job redesign in combining employee initiative and employer authorization (Rousseau, 2004, 2005). This combination raises important implications: (a) their broader scope than self-enacted changes (i.e., substantial job modifications can require supervisor agreement); (b) employee protection from employer sanctions (e.g., as opposed to disregarding rules or overstepping competencies; Morrison, 2006); and (c) employer authorization to enhance the functionality of the job's design (i.e., critical work gets done).

Given their capacity for personalization and flexibility, task i-deals hold promise for a dynamic and individualized approach to work redesign. Top-down interventions are typically tied to the introduction of new jobs, technology, or structural changes. They derive from the questionable belief that employers have substantial information and insight into worker needs (Hackman & Oldham, 1980; Roberts & Glick, 1981). Individual job crafting in turn is constrained by both limited worker discretion over job duties and incomplete knowledge of how jobs changes impact others (Wrzesniewski & Dutton, 2001). Task i-deals enable joint employee–employer influence over the extent, timing, pace, and content of work redesign. I-deals can provide workers with greater influence and control, for mutual employee and employer benefit; while remaining embedded in social and organizational relationships. Implying differential treatment, a tension between flexibility and fairness is inherent in i-deals (Rousseau, 2001; Rousseau et al., 2006). Their defining features—as personally sought and individually authorized—may disadvantage certain workers, inserting a necessary consideration of worker power and influence into job design theory.

Research implications

As a new construct, considerable research remains to be done on task i-deals. Empirical models in our study do not offer a comprehensive test of our tripartite framework of job design. Future research should address three sets of issues, suggested by our results.

Person–job fit

Theoretically, task i-deals contribute to P-J fit by increasing the congruence of individual abilities, needs, and goals with the nature of job activities (Edwards, 1991; Kulik et al., 1987). Optimal P-J fit is a person-specific and evolving equilibrium, determined by interpersonal differences (e.g., control orientations, growth need strength) and intrapersonal changes (e.g., maturation, development of skills and abilities over time). People differ to some extent in how they react to ostensibly the same job based on their motives, skills, abilities, and personal preferences (Hackman & Oldham, 1975; Parker, Wall, & Cordery, 2001; Spector, 1992). Due to processes of learning and psychological automation (i.e., storage of the necessary operations as mental subprograms; Hacker, 2003), tasks that once were personally challenging and motivating, can become routine jobs, thus eroding their intrinsic motivation potential over time (Katz, 1978). Task i-deals offer a means to accommodate a job's design to interpersonal differences and intrapersonal changes, corresponding with the individual and dynamic character of P-J fit. Longitudinal studies, directly assessing changes in the alignment of work characteristics with individual differences and attributes (e.g., personal traits, orientations, or aspirations), are needed to substantiate this theoretical connection. We also encourage researchers to make of use of naturally

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occurring quasi-experiments (e.g., introduction of new work forms; Hornung et al., 2008) to assess the potential of task i-deals to enhance P-J fit.

Proactive behavior

Research on proactive behavior provides rich theory and well-developed taxonomies for various forms of employee influence (Grant & Ashford, 2008; Griffin et al., 2007; Parker & Collins, in press). Further empirical studies should establish the extent task i-deals fit in or differ from existing frameworks used in research on proactive behavior. A topic of special interests is potential reciprocal relationships among PI, work characteristics, and task i-deals over time. Another is the interplay between task i-deals and bottom-up job modifications (e.g., job crafting) as complementary or alternative strategies (e.g., where authorization is necessary, or where i-deals are discouraged or denied). The first topic requires cross-lagged analyses, whereas the second may be better studied via qualitative methods.

Context

The creation of i-deals as well as their individually and collectively attributed meaning partly depends on the cultural and organizational context of these arrangements (Rousseau, 2005). In both our studies, successful task i-deal creation was facilitated by LMX. I-deals based on LMX are not granted arbitrarily. Typically, trusted and valuable performers are party to high LMX relationships. This corresponds with the premise of i-deal theory that these arrangements are based on worker value to the employer (Rousseau et al., 2006; Gerstner & Day, 1997).

Despite the comparable role of LMX in out two studies, the structural influences of job level, organizational tenure, and part-time employment were factors only in the German study. If Germany generally can be assumed to be a higher power-distance culture than the US (e.g., Van der Vegt, Van de Vliert, & Huang, 2005), this is especially true for German hospital physicians, an occupational group adhering to a strong professional hierarchy. Hierarchical structures and authoritarian leadership can create obstacles to the negotiation of i-deals, increasing the risk of negative consequences in case of denied requests (e.g., reprimand by the supervisor to focus on assigned tasks). In hierarchical settings generally (e.g., government agencies), lower-ranking workers may find it especially difficult to negotiate task i-deals. Negative perceptions of their own bargaining position and anticipated unfavorable negotiation outcomes may prevent them from seeking out task i-deals in the first place. Higher status workers have easier access to employer agents at the executive level (e.g., CEO, HR director), providing opportunity to bypass a poor supervisor relationship in negotiating special terms.

Comparative studies are needed to better identify contextual effects on task i-deals. Although our studies demonstrated parallel antecedents and consequences for task i-deals in two national and organizational settings, hierarchical status, seniority, and formal employment conditions had effects on task i-deals only in the German study of physicians, the occupational group omitted in the American study of hospital employees. To overcome our study's limitations we recommend comparisons of similar occupational groups (e.g., physicians, managers) across different national and/or cultural settings, using identical, validated measures.

Limitations

Limitations arise from our use of cross-sectional and single-source data. In Study 1, partialing out a common method factor caused the weaker paths from task i-deals to control and from control to PI to lose significance (Podsakoff et al., 2003). In Study 2, the path from stressors to WE, was affected, but sustained in an alternative test. Overall, common method bias did not appear to undermine our findings, though support for the task i-deals–control–PI relationship in Study 1 is limited. Theoretically, reverse

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causation is a greater problem in Study 1, as previous research has found reciprocal relationships between PI and work characteristics (Frese et al., 2007). Over time, relationships between constructs may be bi-directional; cross-lagged studies are needed to establish the dominant effect in a given measurement interval (i.e., PI as an antecedent for seeking out i-deals and a consequence of re-negotiated work characteristics; Hornung et al., 2008). In the present study, our tests of a battery of alternative structural models did not indicate theoretical misspecification. Regarding the cross-sectional nature of our data, however, alternative model tests do not allow causal inference. We thus note that applied statistical remedies are inherently limited and do not substitute for multiple measurement points and data sources (e.g., supervisor–worker dyads).

The extent of reported i-deals was low in both settings, consistent with findings in previous i-deal research (Hornung et al., 2008, in press). Human resource frameworks and work design practices in formalized organizations are based on standardization. Personal arrangements tend to be more the exception than the norm (Rousseau, 2004, 2005). Due to general robustness of SEM to non-normality, low mean scores are not a major problem, but impose some constraints (e.g., Olsson, Foss, Troye, & Howell, 2000). Moderate sample size and low base-rate in task i-deals may limit the power of our studies to identify effects. For example, despite significant indirect effects, the raw correlation between task i-deals and PI was non-significant in Study 1. In both studies, commonly studied interaction effects of work characteristics on outcomes (PI, WE) were tested in additional regressions, but were not significant.

Comparability between our two studies is restricted by use of different measures for LMX and task i-deals and partial non-invariance of work characteristics. Study 1 identified requisite changes to the task i-deals measure, providing the basis for the improved measure in Study 2. Items were reformulated to refer more unequivocally to work tasks, which improved the scale's psychometric properties (i.e., internal consistency and factor loadings). Conceptualizing task i-deals as a special form of development i-deals, our study does not provide information on the discriminant validity of these two types. Further scale development is needed to examine the distinctness among facets of developmental i-deals such as job content, off-the-job training, and career advancement. For research into employee development opportunities, the more general development i-deal measure used by Hornung et al. (2008) is suitable; studies of job design are better served by the task i-deals measure developed here.

Differences in work characteristics between the studies should be noted. Means for complexity were comparably high (Study 1: $M = 3.95$, $SD = 0.67$; Study 2: $M = 4.05$, $SD = 0.61$; $t(322) = 1.37$, $p > .05$), but German physicians rated their personal control considerably lower ($M = 2.94$, $SD = 0.80$) than workers in the occupationally diverse American sample ($M = 3.71$, $SD = 0.84$; $t(322) = 8.29$, $p < .01$). Moreover, complexity and control were interrelated in Study 1 ($r = .40$ $p < .01$), but not in Study 2 ($r = .11$ $p > .05$; $\Delta r = .29$, $z = 2.75$, $p < .01$). These contextual differences might be due to the nature of physician work. Hospital physicians typically have high-strain jobs (Karasek, 1979), which combine high job demands with limited control (e.g., hierarchical structures, regulations, need to respond to patient condition). The weak role control played is Study 1's structural model thus may due to its higher base rate and empirical overlap with job complexity. Alternative explanations include inflated responses in the American sample due to social desirability (e.g., Paulhus, 2002; Schwarz, 1999). Concepts of decision authority and discretion hold different meanings across cultures (e.g., the American image of the autonomous individual) and organizations (e.g., efforts to promote empowerment in Study 1). Enjoying higher formal education, physicians may also have more differentiated mental models about their work. However, due to the heterogeneity in Sample 1 and the fact that the English version of our work characteristics scales had not been previously validated, these interpretations are tentative.

Our use of parceled indicators is another potential limitation. Parceled SEM is a methodological hybrid of path analysis and item-level latent models (Coffman & MacCallum, 2005). Although our

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measures overall displayed good psychometric quality, second-order work characteristics of complexity and stressors received lower and less balanced loadings from their indicator parcels than did control or other measures (LMX, PI, WE). Considering the conceptual breadth of these higher-order factors, this was not unexpected. It brings to bear a distinct advantage of SEM, where associations between unobserved variables account for different contributions of multiple indicators (Byrne, 2001).

Questions about sampling bias are raised by non-participation of roughly half of the potential respondents, for which no systematic data were gathered. In both settings, ongoing restructuring under economic pressure, staff turnover, and widespread distrust of management presented obstacles to participation. All respondents signed a letter of consent approved by the internal review board of the respective university, informing them that participation was voluntary, without personal gain, and confidentiality was guaranteed. These forms were collected separately from the survey, but required the participant's signature raising additional concerns about anonymity, a typical explanation for non-response.

Practical implications

Task i-deals play an important role in the successful planning and implementation of organization-wide changes of many kinds. However, they should be considered as supplements rather than substitutes for systematic top-down efforts. Systematic efforts to design intrinsically motivating jobs can be improved both by active employee involvement in the broader process and by local negotiations to better align jobs with individual and organizational needs. Task i-deals can also serve as pilot tests for future redesign activities or be used when managers and workers refine broad-scale changes to make them more applicable locally. Using and managing i-deals requires practitioners to reflect upon their assumptions on standardization versus flexibility, equality versus fairness, and the distribution of authority among employers, their agents (e.g., managers, supervisors), and the individual employee. Obstacles to the negotiation of i-deals occur when supervisors or agents believe themselves to lack authority to grant such modifications (e.g., inflexible organizational rules, a bureaucratic culture, or a punitive environment promoting rigidity). Their beneficial effects may also be undermined, if task i-deals are made in secrecy or granted in ways that are not transparent or legitimate in the eye of co-workers (e.g., based on personal liking rather than past and anticipated contributions to the organization). Attention to justice issues is essential to effective use of i-deals (Lai, Rousseau, & Chang, 2009).

Conclusion

Work design is not a homogeneous process. It can be achieved via several means and impacts multiple constituents, raising the question: ''Design in whose view?'' (Weick, 2001, p. 65). The redesign interests of workers and employer converge in individually negotiated task i-deals. They address a fundamental issue in job design theory and practice, how to resolve tensions between authority exercised by the employer and employee needs for self-determination and personal growth. A form of influence workers exert on an employer, i-deals reflect the contemporary shift in risk and responsibilities from employers to individual workers. As such, task i-deals are a means to expand the theory and practice of job design to reflect fundamental changes in the employment relationship itself.

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Peter Angerer (PD, MD) is head physician at the Institute for Occupational, Social, and Environmental Medicine of the Ludwig-Maximilians-University in Munich. A certified specialist for cardiology, internal medicine, environmental medicine, and occupational medicine, he heads the Institute's outpatient clinic as well as its research group on clinical occupational medicine. Areas of his research are preventive cardiology (especially psychosocial aspects), work physiology (shift work, work in oxygen reduced atmosphere), and occupational health promotion projects with different topics and in various settings (e.g., occupational stress management and obesity prevention for industrial workers, health empowerment for the unemployed). He has been the principal investigator of a larger project on work and health of hospital physicians, on which parts of the present study were based.

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