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Breaking Out Of Open-Plan:

Extending Social Interference Theory Through An Evaluation of Contemporary Offices

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Key Words:

Office Design, Social Interference, Communication, Work Design

Abstract

Offices are evolving rapidly to facilitate organizational cost reductions and to better support contemporary working practices. We investigate relationships between the design of contemporary offices (physical proximity and break-out areas) and autonomy in predicting individual outcomes (ease of communication, job satisfaction, and wellbeing). We extend Social Interference Theory to include features of contemporary office design and explicitly explore the moderating role of autonomy. Working in differing office configurations of a global engineering company, 406 employees provided data. Access to break-out areas was strongly related to ease of communication, higher job satisfaction, and wellbeing. In the absence of break-out areas, employees with higher autonomy were able to better manage the challenges arising from contemporary offices. Practical implications include: incorporating break-out areas to enhance employee experience within open-plan offices; using job design to optimize employee experience in open-plan offices; and manager and employee involvement in office design.

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Introduction

Workspaces (e.g., offices, factories) constitute the second greatest financial overhead for most organizations after human resources (McCoy, 2005), and investments to design new or to optimize existing space can be substantial (Davis, Leach, & Clegg, 2011; Vischer, 2005). Offices are the most common form of workspace for the majority of employees in developed nations (Bodin Danielsson, & Theorell, 2018; Brill, Weidemann, & BOSTI Associates, 2001), with open-plan designs (usually lacking interior walls, containing groups of workstations and meeting rooms) widely used (Boje, 1971; Brill et al., 2001; Hongisto, Haapakangas, Varjo, Helenius, & Koskela, 2016). The prevalence of open-plan offices can be attributed to: (1) claims about their ability to improve employee communication (e.g., Brookes & Kaplan, 1972; Lee & Brand, 2005); (2) the increased number of employees that can be accommodated (Vischer, 2005); (3) the reduction in operational overheads (Duffy, 2000; Davis, 2019); and (4) the high degree of flexibility (i.e., capacity to re-organize space) afforded (Davis et al., 2011).

The open-plan office is evolving (McElroy & Morrow, 2010; Morrison & Macky, 2017), however, largely driven by an increase in knowledge working (Davenport, 2013). The diverse, complex and highly interactive nature of such work (Parker, Morgeson, & Johns, 2017) is forcing a re-think of the type of space that organizations should provide their employees. There is now a shift in emphasis toward supporting communication and information flows (De Croon, Sluiter, Kuijer, & Frings-Dresen, 2005; Heinzen, Cacciatori, Zoller, & Boutellier, 2018; Price, 2007), increasing workspace diversity (Göçer, Göçer, Ergöz Karahan, & İlhan Oygür, 2017; Wohlers & Hertel, 2017), and improving the experience for office occupants (Elsbach, & Bechky, 2007; Seddigh, 2015; Zerella, von

Treuer, & Albrecht, 2017). These changes represent a less static view of what employees require from their offices (Brunia, De Been, & van der Voordt, 2016).

To-date, practice is charging ahead of research and theory. The design of innovative offices is often based on managers' intuitions in regard to employee work patterns (Kaarlela-Tuomaala, Helenius, Keskinen, & Hongisto, 2009), and research on the impact of such spaces is still developing (e.g., Bodin Danielsson & Theorell, 2018; Göçer, et al, 2017). Moreover, the available literature can be criticized for frequently failing to consider underlying theory (focusing instead on describing outcomes). There is a tendency to ignore existing conceptual frameworks that may explain employees' responses to, and behaviors in, their workspace (Elsbach & Pratt, 2007). Accordingly, empirical studies that systematically test conceptual models are required to develop an evidence base of human behavior within the workspace context.

In this paper we set out to provide insights in regard to the interaction between individual employees and their physical environment (cf., Ferguson & Weisman, 1986; Johns, 2006; Parker et al., 2017). We extend Social Interference Theory (SIT) (Oldham, Cummings, & Zhou, 1995) to reflect contemporary work environments and, in so doing, develop the empirical base relating to this theory. We go beyond simple accounts of how employees respond to a given environment, testing an explanation for why we may see differential outcomes. We report research that used a naturally-occurring field study to evaluate contrasting features of contemporary open-plan office design within a global engineering organization. In some offices the organization had sought to support communication through using more compact desks to increase the physical proximity of employees (seating them closer together) and incorporated break-out areas on an ad hoc basis to facilitate informal discussion. We test a series of hypotheses concerning differences in

physical proximity between employees and their access to break-out areas in predicting employees' experience of communication, job satisfaction, and wellbeing. We also consider the interaction between the physical environment and job autonomy (i.e., the extent to which employees are able to make decisions concerning how, when and where to perform tasks, Daniels, Le Blanc, & Davis 2013).We test whether there are differential outcomes for individual employees within open-plan offices and go beyond traditional assumptions that the office environment affects all occupants in a similar way (Davis, 2019; Duffy, 2000). The next section begins with a review of the impact of workspace design on employees, introducing SIT (Oldham et al., 1995) as a perspective to interpret outcomes.

Workspace Design and Social Interference Theory

Workspace design has long been recognized as promoting, constraining, and influencing individual employees' behaviors and perceptions, including creativity, wellbeing, interpersonal interactions, performance, and satisfaction (Bodin Danielsson, Chungkham, Wulff, & Westerlund, 2014; Brookes & Kaplan, 1972; Dul et al., 2011; Hongisto et al., 2016; Oldham & Brass, 1979). Despite the diverse range of perspectives and approaches adopted in prior research, evaluations concerning the impact of differing office designs on employee behavior have often concerned employees moving from traditional individual or small cellular offices to larger, shared, open-plan ones (e.g., Brennan, Chugh, & Kline, 2002; Oldham & Brass, 1979). In reality, contemporary office designs are now overwhelmingly open-plan in one form or another (Hongisto et al., 2016). Questions around the impact of open-plan designs on occupants should now focus on examining relative design differences between contrasting open-plan configurations, particularly those optimized for modern work practices (Morrow, McElroy, & Scheibe, 2012).

A major criticism of much of the research into the role of the physical environment in organizations is its atheoretical nature (Elsbach & Pratt, 2007; Morrow et al., 2012). In this paper, we respond to Morrow, McElroy, and Scheibe's (2012) call to extend Social Interference Theory (SIT) to contemporary office designs. SIT (Oldham et al., 1995) was developed through extensive review and analysis of existing empirical studies examining occupant reactions to different forms of workspace (Fried, Slowik, Ben-David, & Tiegs, 2001). SIT identifies four configurational features of office design (density, openness, proximity, and workstation boundaries) as being instrumental in eliciting employees' psychological and behavioral responses. SIT predicts that office configuration affects the number of unexpected or unwanted social interactions that an employee encounters, which in turn affects individual control and goal attainment, thereby influencing work-related outcomes such as performance and satisfaction (Davis et al., 2011).

Oldham et al. (1995) argue that unwanted (and even welcome but unexpected) social interactions might come at a cost in terms of increased cognitive demand and information overload. This cost might affect other aspects of an employee's work or reduce the subjective experience for the individual. On the other hand, unplanned interactions could bring positive personal and organizational benefits. For example, more frequent unplanned social interactions within an office environment might provide greater opportunity for serendipitous discussions and meetings. These interactions might in turn lead to positive outcomes such as timely information exchange, development of broader job knowledge, product innovations, or extended social networks (e.g., Allen & Henn, 2007; Heinzen et al, 2018). SIT provides a way of understanding and explaining these contrasting outcomes, in addition to why individuals might respond quite differently within similar open-plan environments (e.g., Brennan et al, 2002; Wohlers & Hertel, 2017). We extend SIT to include ease of

communication as an outcome. This extension reflects the increased emphasis that organizations are placing upon open-plan offices to facilitate communication and spontaneous interactions (Heinzen et al., 2018; Zagenczyk, Murrell, & Gibney, 2007), together with the positives that such interactions provide.

Within SIT individual autonomy is a central mechanism by which the level of unexpected interaction and potential interference might be moderated (e.g., Morrow et al., 2012). Autonomy enables employees to reduce the interference caused by unwanted social interactions while retaining those interactions that yield effective or desired communication. We directly explore the differential effects that might result under different office configurations where employees enjoy varying levels of autonomy over their work. This permits us to examine the moderating mechanism of autonomy and provide a more nuanced interpretation of the trade-offs inherent in open-plan working (Elsbach & Pratt, 2007; Davis et al., 2011).

We further seek to contribute to the development of SIT by examining the relationship between features of differing open-plan configurations for modern work practices. We study offices where occupants already work in highly open configurations; that is, environments that lack physical boundaries around work areas and are highly dense in regard to occupancy. This context enables the examination of differences in a core configuration element of SIT, namely physical proximity, without confounding effects from changes in other aspects of the traditional open-plan office configuration. We also extend SIT by examining the influence of break-out areas on employees, going beyond the traditional view of open-plan as uniform spaces varying ostensibly in their relative openness or density. Although the provision of break-out areas is a relatively new phenomenon, such areas are becoming ubiquitous within contemporary open-plan offices (Davis et al., 2011; McElroy &

Morrow, 2010; Steiner, 2005). The use of such areas is typically driven by the belief that they support discussions and spontaneous meetings (Price, 2007).

SIT argues that the configuration of the office environment may result in negative personal outcomes due to the increased social interference and diminished autonomy. This can be expected to affect overall satisfaction and ultimately result in withdrawal (turnover and absence) from the environment. Past research has also demonstrated that office design can influence employees' physical and emotional wellbeing (Danielsson & Bodin, 2008). We argue that these outcomes might be a more sensitive and widely shared response to the physical environment than either turnover or absence. Changes in turnover or absence might only be observed in extreme cases and could also be influenced by other factors such as the availability of alternative employment. We extend SIT by including affective wellbeing as an outcome, in addition to satisfaction.

We discuss the application of SIT to the contemporary open-plan offices examined in our study and present specific hypotheses in the sections below.

Employee Responses to Proximity and Break-Out Areas

Proximity

Increasing the numbers of employees housed within a given office space can allow organizations to make substantial cost savings (e.g., Duffy, 2000; Pitt & Bennett, 2008). However, precise operationalization of concepts is important to ensure that changes to the physical environment are adequately captured. It is important to distinguish between the related concepts of setting density (the number of employees within an office divided by the total area, Oldham et al., 1995) and physical proximity (how close employees' desks are located to one another, Oldham et al., 1995). Both concepts have been identified by SIT as key to occupant reactions, however, prior studies have often conflated or failed to distinguish

between them adequately (Davis et al., 2011; Marquardt, Veitch, & Charles, 2002). The prevalent trend in contemporary open-plan office design is to increase the amount of space dedicated to specific task spaces, such as break-out, group work areas, or quiet spaces, within open-plan offices (Göçer et al., 2017; Wohlers & Hertel, 2017). This change in design is often accompanied by the use of smaller desks or desks placed more closely together (i.e., greater proximity) to limit increases in floor space. Thus proximity may increase within a constant overall level of density (e.g., Allen, Bell, Graham, Hardy, & Swaffer, 2004). Physical proximity, arguably, offers a more sensitive measure of the experience of interpersonal distance between colleagues at their desks, consequently we focus upon this within our study.

SIT suggests that high proximity environments may increase the opportunities for interactions with immediate colleagues, but that such designs can also have negative consequences (Brennan et al., 2002; Seddigh et al., 2015) through increased social interference and cognitive distraction. Congruent with SIT, communication and interaction patterns have been shown to benefit from greater proximity (Allen & Henn, 2007). Furthermore, an increase in the number of colleagues within the immediate vicinity has been found to increase information exchange between employees (Heinzen et al, 2018; Szilagyi & Holland, 1980). However, higher density and proximity offices have been associated with lower job or work satisfaction (e.g., Oldham, 1988; Oldham & Fried, 1987). This outcome is most likely the result of social interference and disturbance from unplanned interactions that can undermine employee concentration (c.f., Sundstrom, Town, Rice, & Osborn, 1994). These findings suggest that higher proximity might present a trade-off in individual outcomes. We might simultaneously observe both positive and negative outcomes. Greater proximity might promote increased unplanned social interactions and higher ease of

communication, while at the same time generating greater social interference and negative psychological outcomes (Davis, 2019).

Hypothesis 1a: Higher proximity positively predicts ease of communication.

Hypothesis 1b: Higher proximity negatively predicts job satisfaction.

Hypothesis 1c: Higher proximity negatively predicts wellbeing.

Break-Out Areas

The provision and use of break-out areas is a relatively new phenomenon in contemporary office design (Morrow et al., 2012), being incorporated as a cost effective means of providing employees with access to impromptu meeting space (Davis et al., 2011). Viewed through the lens of SIT, the use of break-out space can be seen as a design choice that reduces physical barriers to meeting and interacting with colleagues, with the expectation that this would improve communication. We contend that this increase in interaction would not necessarily heighten unwanted social interference for employees because break-out areas are explicitly intended to house discussion and communication. In other words, they do not act as a multipurpose space (such as desk areas within traditional open-plan) where individuals work on cognitively demanding tasks while also balancing interactions and intrusions from others. Indeed, access to a break-out area might improve job satisfaction and wellbeing of employees by providing a separation of areas within the office for individual vs. collaborative tasks (see, Wohlers & Hertel, 2017).

This argument has some support from extant literature. Offices with break-out areas have been found to be more conducive to team interactions and communication than offices without (McElroy & Morrow, 2010; Peterson & Beard, 2004). Offices with higher levels of formal and informal space available for collaboration have been associated with higher face-to-face collaboration (Stryker, Santoro, & Farris, 2012). Easy access to traditional meeting

rooms has been associated with higher job satisfaction (Lee & Brand, 2005). Occupants in offices that contain multiple task spaces (including break-out and discussion spaces) report lower distraction than employees within traditional open-plan (Seddigh et al., 2015). Furthermore, surveys of occupants in a variety of office types have found higher levels of satisfaction and wellbeing in offices that include a variety of spaces within open-plan compared to those that do not (e.g., Danielsson & Bodin, 2008). We therefore expect employees with access to break-out areas to experience improved ease of communication together with greater job satisfaction and wellbeing.

Hypothesis 2a: Access to break-out areas positively predicts ease of communication.

Hypothesis 2b: Access to break-out areas positively predicts job satisfaction.

Hypothesis 2c: Access to break-out areas positively predicts wellbeing.

The Interactive Environment of Open-Plan Offices

The literature contains a litany of inconsistencies and paradoxes in regard to outcomes for employees in seemingly similar open-plan offices (Davis et al., 2011; De Croon et al., 2005; Elsbach & Pratt, 2007; Wohlers & Hertel, 2017). For example, higher density has been found to predict both increases and decreases in satisfaction (Elsbach & Pratt, 2007). SIT helps to explain why this might be the case. Individual differences in perceptions of autonomy and the nature of work goals (activities) influence the extent to which social interference, facilitated by the physical environment, affects work related behaviors and attitudes (Oldham et al., 1995). Furthermore, past studies have demonstrated that workspace features, such as density, might differentially affect groups of employees due to broad job-level differences in their roles and activities (e.g., Charles & Veitch, 2002; Fried et al., 2001; O'Neill, 1994; Sundstrom, Herbert, & Brown, 1982).

SIT envisages a relatively simple relationship between the configuration of the office environment and the influence that this then exerts on perceptions of autonomy and ultimately the response to social interference. Researchers have tended to view the physical environment as a feature that might affect employees' perceptions of the control they have within their work, namely job autonomy (e.g., Oldham & Brass, 1979; Oldham & Rotchford, 1983; Szilagyi & Holland, 1980), rather than job autonomy interacting with the physical environment to shape behavior (c.f., Backhouse & Drew, 1992; Duffy, 1997). We argue that how employees use their office and organize their work tasks will be dependent on the level of job autonomy afforded to them. For example, employees who enjoy high levels of autonomy might be able to choose when and where to work on particular tasks.

There has been limited consideration of the interaction between the configuration of office space and job design (Humphrey, Nahrgang, & Morgeson, 2007; Parker et al., 2017). Findings from related concepts, though, support our assertion that autonomy might interact with features of the workspace configuration. For example, Huang, Robertson, and Chang (2004) found that environmental control/autonomy allows employees to deal with task and work demands more effectively through optimizing their office to support collaborative and individual tasks. Furthermore, studies suggest that the provision of choice over aspects of one's environment and the perception of control over these choices is beneficial, with employees being more satisfied with their environment (e.g., Barnes, 1981). More broadly, consideration of control/autonomy as a moderator of physical, psychological, or organizational demands/stressors has received much support. Substantial investigations have demonstrated that high demands are much more bearable and even enjoyable when accompanied by high levels of personal control or autonomy (e.g., Daniels & Guppy, 1994; de Lange et al., 2003; Karasek & Theorell, 1990; Leach et al., 2013). This observation

supports our view that autonomy and the ability to exert control over how and when tasks are undertaken will moderate the effects of the physical environment.

We have argued that autonomy should be considered as a moderator of the physical workspace, however, we cannot consider individual features of the office layout in isolation; greater sophistication is required to reflect the differences that employees might experience under varying spatial configurations (Davis, 2019; Oldham et al., 1995; Wohlers & Hertel, 2017). In regard to the present study, we examine the relationship between different combinations of proximity, access to break-out areas, and autonomy in determining employee outcomes.

We can think of these interactions in terms of outcomes for specific employees. For example, it could be the case that employees working in the same high proximity office, with access to a break-out area may enjoy very different experiences depending upon the level of autonomy they hold. Employees with high autonomy may be able to decide to move to work from break-out areas as and when they choose, switching tasks and activities to capitalize on other colleagues' availability or in response to information that has been shared. Conversely, an employee with low autonomy may have less control over when to work on specific tasks. They may have to continue with a demanding design task even when being part of a desk-side conversation concerning an unrelated piece of work. Alternatively, they may simply feel less able to make use of their nearby break-out area spontaneously. In such a case, we would expect relatively high ease of communication, with an opportunity to move some discussion to the break-out area (albeit less self-initiated). However, wellbeing and job satisfaction may be lower as the employee would have less opportunity to manage the social interactions or take action to adjust their tasks. By extension, an employee in the same high proximity office, without access to a break-out area and lower autonomy may be expected to experience worse

outcomes again. Without a physical break-out area to retreat to for confidential or in-depth discussion and collaboration, the management of social interactions is limited. The opportunity to mitigate the effects of desk-bound social interaction through task control is constrained and would be expected to result in lower job satisfaction, wellbeing and ease of communication than in the other scenarios.

In summary, break-out areas, physical proximity, and autonomy should be treated in combination rather than in isolation to predict ease of communication, wellbeing, and job satisfaction (c.f., Fried et al., 2001; Oldham et al., 1995; Zalesny & Farace, 1987). In line with our eariler reasoning, we test the following hypotheses (see Figure 1 for a diagramatic representation of hypothesized relationships):

Hypothesis 3a: Access to break-out area, high proximity, and high autonomy will interact to predict higher ease of communication.

Hypothesis 3b: Access to break-out area, high proximity, and high autonomy will interact to predict higher job satisfaction.

Hypothesis 3c: Access to break-out area, high proximity, and high autonomy will interact to predict higher wellbeing.

Method

Organizational Context

We report an investigation within a number of the UK offices of a global engineering company. Staff comprised a professional engineering community involved in the design of complex engineering products for highly competitive global markets. We gained access to the occupants of a range of open-plan offices to investigate differing office designs. The context presented a unique opportunity for a controlled comparison due to the relative standardization of corporate appearance, work roles, office size, and established open-plan conditions.

The organization's performance is very much dependent upon the cooperation, knowledge transfer, and decision making that occurs within and between various areas (e.g., product design, engineering, manufacture). Success in these areas therefore hinges upon effective communication. The nature of the skilled work that the company engages in often requires problems to be resolved as and when they occur. They were interested in assessing how differences between their open-plan office configurations related to the broader work experience for staff (job satisfaction and wellbeing) as well as communication.

The company has focused on increasing communication for some time and has utilized large traditional open-plan offices for many years. This practice has allowed managers to co-locate the majority of employees for a particular project, or to group functional units in single open-plan offices. Break-out spaces have been incorporated in a piecemeal fashion.

Break-out spaces are accessible spaces within the office that contain circular tables (1.2m-1.5m in diameter) with between four and six chairs. These spaces were non-bookable and typically located between rows or clusters of desks, without any surrounding walls or acoustic screens. The spaces were designed to provide convenient access to space for discussions and impromptu informal meetings between office occupants as-and-when needed.

Desks differed between offices within the study. Some offices incorporated large corner facing desks that provided generous distances between colleagues. Other offices contained shallower straight bench style desks that reduced the distance between neighboring employees. As a result, proximity was significantly higher in the offices with bench style desks than in the offices with corner facing desks (see *Measures* for details). In both settings, desks were divided using low-level desk partitions (less than 25cm high). The dividers were intended to prevent computer equipment and papers spilling over between desks, as opposed

to acting as a visual barrier. The higher proximity offices included provision for future-staff increases and storage, consequently there were no significant difference in setting density between the high and low proximity offices. The offices had a setting density of between 8.1 and 11.1 m^2/person, within UK norms (Offices, 2013). The offices housed between 85 – 260 occupants.

There was a wide variation in break-out space provision between both high proximity and low proximity offices (see Table 1 for distribution of respondents between the comparison groups). As such, the two design features that form the focus of this study (proximity and break-out access) were largely independent of one another and, given the research design, it is possible to examine their independent effects.

Sample and Data Collection

An online survey was administered to employees. Respondents were asked to select the office in which they worked from a predefined list, identified as either a higher or lower proximity office. There was consistent variation in break-out space between the higher and lower proximity offices. The sample consisted of 406 respondents (257 in high proximity offices and 149 in the low proximity offices) with an overall response rate of 27%. Of the sample: 82.5% were male, reflecting the predominantly male workforce, 21.7% were managers, 60.8% were design engineers, 17.5% were administrative or support staff, and 32.3% of respondents had supervisory responsibilities.

The sample contained a balanced distribution between the various office configurations (see Table 1 below). Respondents were drawn from all four distinct physical conditions: break-out space and high proximity; break-out space and low proximity; no break-out space and high proximity and; no break-out space and low-proximity.

INSERT TABLE 1 ABOUT HERE

Measures

Physical measures.

Physical proximity has been defined as the distance between an employee and his/her nearest colleague (Sundstrom et al., 1980). Physical proximity was calculated by measuring the typical distance between the midpoints of two adjacent desks, in the reconfigured and traditional offices, using ArchiCad 15 and electronic office plans. This produced a distance between adjacent employees for both groups. Occupants of offices with bench style desks were seated 20cm closer to each colleague on their left and right sides, in addition to colleagues seated opposite them. Consequently, offices with bench desks were regarded as higher proximity. Offices with larger corner facing desks were regarded as lower proximity.

Break-out area access was assessed by asking respondents "Does your team's workspace include a break-out area (e.g., an area that can be used for informal or spontaneous meetings or chats)?" This item required individuals to report "yes" or "no". 'Your team' refers to large functional units in which individuals were located. This self-report item was regarded as clear and unambiguous without obvious demand characteristics (Robinson, 2018; Weber & Cook, 1972). Self-report measures of the physical environment have been successfully used in past studies (e.g., Fried, 1990; McElroy & Morrow, 2010; Sundstrom et al., 1980). The overt nature of the physical environment has been suggested as a factor that should lead to high concordance between external and perceptual measures of these factors (Fried, 1990). To further validate this measure, the general pattern of results within each office was inspected, specifically the proportion of break-out area was calculated. ArchiCad 15 was used to analyze the electronic office plans and measure the total area of each office that constituted break-out areas. This figure was then divided by the number of occupants to

arrive at a value of break-out area per person. As expected, a greater proportion of respondents in offices with higher amounts of break-out space reported access to break-out areas.

Perceptual Measures.

Autonomy was measured using Jackson, Wall, Martin, and David's (1993) six-item measure, which has been used extensively in organizational psychology studies (e.g., Holman et al., 2010; Ohly & Fritz, 2010; Parker, 1998; Parker, Wall, & Jackson, 1997). The six items included "Can you vary how you do your work?" and "Can you vary how to go about getting your job done". Items were measured on a five-point rating scale (Not at all – A great deal). The measure demonstrated high internal reliability (Cronbach's α=.83).

Ease of communication was measured using a previously validated two-item measure of internal office communication (O'Neill, 1994): "The office environment allows to me to communicate effectively with others" and "How satisfied are you with your ability to communicate with others in your workspace?" Items were measured on a five-point Likert scale (Strongly disagree – Strongly agree). The measure demonstrated good internal reliability (Cronbach's α=.78).

Job satisfaction was measured using Warr, Cook, and Wall's (1979) 16-item measure. Items included: "How satisfied are you with……Your fellow colleagues", "The way your firm is managed", "The recognition you get for good work". Items were measured on a seven-point rating scale (Very dissatisfied – Very satisfied). The measure demonstrated good internal reliability (Cronbach's α=.90).

Wellbeing was measured using the short form of Warr's (1990) depression-enthusiasm continuum of affective wellbeing. Respondents were asked to indicate the extent to which their job, over the past month, had made them feel: "miserable", "depressed" and

"gloomy". The three items were measured on a five-point rating scale (Never – All of the time). The measure demonstrated good internal reliability (Cronbach's α=.83).

Control variables. Respondents were asked to indicate their sex (male coded as 1, female coded as 0), if they had supervisory responsibility (supervisors coded as 1, or non-supervisors coded as 0) and their job role (Administration, Engineering or Managerial; dummy coded as either Admin or Managerial, with Engineering omitted as the reference category).

Data Preparation.

Data screening did not identify any extreme outliers. We also performed Harman's ex-post single factor test (Podsakoff & Organ, 1986) to check for Common Method Variance (CMV). The results did not indicate the presence of any single uncorrelated latent variable that significantly explained the covariance amongst the questionnaire items, suggesting that CMV is not an issue within these data (Noblet, Rodwell, & McWilliams, 2006).

Results

We first introduce the zero order correlations. Next we present the separate results of hierarchical multiple regression analyses that examined the independent variables of proximity, break-out access, and autonomy as predictors of ease of communication, job satisfaction, and wellbeing. Then we report a test for, and description of, the nature of the interaction between the three independent variables and each of the dependent variables.

Zero order correlations (Table 2) indicate that demographic variables correlate significantly with the study variables and should be included as controls in the subsequent analyses. Males correlated with lower proximity (r=-.16, p<.05), administrator with high proximity (r=.12, p<.05), manager with higher autonomy (r=.17, p<.01), and supervisory responsibility with higher autonomy (r=.17, p<.01) and higher job satisfaction (r=.17, p<.05).

Congruent with the hypotheses, access to break-out areas correlated significantly with ease of communication (r=.14, p<.01), job satisfaction (r=.14, p<.01), and wellbeing (r=.16, p<.01). Autonomy correlated significantly with ease of communication (r=.21, p<.01), job satisfaction (r=.47, p<.01), and wellbeing (r=.33, p<.01).

INSERT TABLE 2 ABOUT HERE

To test the direct and interactive relationships between proximity, break-out access, and autonomy on ease of communication, job satisfaction, and wellbeing, a series of moderated multiple regression analyses were undertaken. The continuous independent variables were centered, in line with recommended procedures for conducting moderated regression (Aiken & West, 1991). The regression analyses were run in four steps. The control variables (sex, supervisory responsibility, and job role) were entered at Step 1, main effects (proximity, break-out access, and autonomy) at Step 2, the two-way interaction terms (the cross-products of the independent variables) at Step 3, and the three-way interaction term (the cross-product of all three independent variables) at Step 4. Results for ease of communication, job satisfaction, and wellbeing are presented in turn below.

Ease of Communication

INSERT TABLE 3 ABOUT HERE

The results for ease of communication are summarized in Table 3. The entry of the control variables at Step 1 was non-significant, F (4, 396) =1.37, p=.25. The main-effect terms at Step 2 account for a significant additional 6.3% of communication variance (F(7, 393) =4.66, p<.01, *F Change* (3, 393) =8.92, p<.01), with break-out access (β = .14, p <.01) and autonomy (β = .21, p <.01) significantly predicting ease of communication. Although the

findings support Hypothesis 2a regarding break-out areas, there is no support for Hypothesis 1a, with proximity not predicting ease of communication.

The three two-way interaction terms, entered at Step 3 were non-significant, suggesting a more complex relationship between the variables, as predicted. Finally, the three-way interaction term was entered at Step 4. In support of Hypothesis 3a, the interaction between proximity, break-out access, and autonomy with ease of communication is significant (β = -.29, p <.05), suggesting differential effects amongst the groups. To better understand the nature of the identified interaction, four break-out access – autonomy groups were created and one proximity slope was plotted per group (Aiken & West, 1991) using Dawson's Excel worksheet (Dawson & Richter, 2006). The slopes are plotted in Figure 2.

INSERT FIGURE 2 ABOUT HERE

The difference between the slopes were then examined by following good practice recommendations (e.g., Perry, Witt, Penney, & Atwater, 2010) and employing Dawson and Richter's (2006) test of slope difference. The slopes difference tests are reported in Table 4.

INSERT TABLE 4 ABOUT HERE

Examining the plot of the interaction and the results of the simple slopes and slope difference tests provides partial support for the hypothesized nature of the interaction. We explore the implications of this pattern of findings further in the discussion section.

Job Satisfaction

INSERT TABLE 5 ABOUT HERE

The results for job satisfaction are summarized in Table 5. The control variables entered at Step 1 account for a significant 3.2% of the variance in wellbeing, F (4, 396) =3.28, p<.05. The main-effect terms at Step 2 account for a significant additional 22.4% of

job satisfaction variance ($F(7, 393) = 19.37$, $p<.01$, *F Change* $(3, 393) = 39.55$, $p<.01$). Of note, break-out access ($\beta = 2.06$, $p < .05$) and autonomy ($\beta = 4.31$, $p < .01$) both significantly predict job satisfaction in this model. In support of Hypothesis 2b, access to a break-out area significantly predicts higher job satisfaction. No support was found for Hypothesis 1b, with proximity failing to predict a significant proportion of the variance in job satisfaction. Contrary to Hypothesis 3b, the models containing the three-way interaction term (Step 4) did not predict significantly more job satisfaction variance than the direct effects.

Wellbeing

INSERT TABLE 6 ABOUT HERE

Table 6 summarizes the results of hierarchical regression analyses relating to wellbeing. The control variables entered at Step 1 were non-significant, $F(4, 396) = 1.37$, $p=.25$. Main effect terms at Step 2 account for a significant additional 12.4% of wellbeing variance ($F(7, 393) = 8.99$, $p<.01$, *F Change* $(3, 393) = 18.91$, $p<.01$). Break-out access ($\beta = .14$, $p < .01$) and autonomy ($\beta = 0.33$, $p < 0.01$) both significantly predict wellbeing. In support of Hypothesis 2c, this suggests that employees with access to a break-out area enjoy higher wellbeing. Contrary to Hypothesis 3c, the model containing the three-way interaction term (Step 4) did not predict significantly more wellbeing variance than the direct effects.

INSERT TABLE 7 ABOUT HERE

Discussion

Our results demonstrate the importance of contemporary office design features (break-out areas) and autonomy in predicting employee outcomes (ease of communication, job satisfaction, and wellbeing). This supports our extension of SIT to include break-out areas as a key element of office configuration and also the moderating role of autonomy within the

theoretical framework. Furthermore, the results confirm the application of SIT as a foundation to examine a broader range of individual outcomes than previously undertaken, namely, job satisfaction and wellbeing. We identified differential effects of office configuration for different groups of employees (three-way interaction). As predicted by SIT, these effects differed in relation to employees' levels of autonomy. We also demonstrate positive outcomes in relation to access to break-out areas. The support for each of our hypotheses is summarized in Table 7. We discuss the major findings below and then reflect upon the implications for research, practice and limitations.

Limited Influence of Proximity

We found no support for our hypotheses concerning main effects of physical proximity (Hypotheses 1a, 1b, and 1c), with variation in proximity on its own appearing not to influence ease of communication, job satisfaction, or wellbeing. This finding is surprising and contrary to expectations based on SIT and the consensus from previous research that reports proximity as an environmental stressor or source of dissatisfaction (Brennan et al., 2002; Elsbach & Pratt, 2007; Oldham et al., 1995; Wohlers & Hertel, 2017). The lack of relationship in the current study, however, might be due to the relatively high level of proximity experienced across all of the office environments. While the offices with bench style desks had a higher physical proximity, this might not have been a large enough increase to significantly alter the actual experience of employees. It might also be the case that once relatively high density/high proximity open-plan working has been introduced, further increases in the degree of physical proximity has little discernible impact on employees.

The Positives of Access to Break-Out Areas and Autonomy

The findings concerning break-out access are striking, with access to break-out areas positively predicting ease of communication, job satisfaction, and wellbeing (in line with

Hypotheses 2a, 2b, and 2c). These findings corroborate our assertion that SIT should be extended to include features of contemporary open-plan offices. Specifically, that access to break-out areas would enhance our understanding of employees' relationships with different open-plan office configurations. We reasoned that break-out areas would be beneficial because they offer employees the opportunity to exercise control over where interactions take place and where they conduct specific work tasks. This viewpoint corroborates prior architectural observations regarding the potential for break-out areas to support communication (e.g., Peterson & Beard, 2004; Turner & Myerson, 1998) and also helps to explain their general popularity in practice (Göçer et al., 2017). Our findings support previous studies that have found a relationship between contemporary office environments (incorporating the use of additional task spaces) and higher job satisfaction and lower stress ratings (e.g., Danielsson & Bodin, 2008).

We also supported the general observation within the job design literature regarding the positive role of autonomy (e.g., Parker et al., 2017). Our study demonstrates that such benefits extend to employees' reactions to, and interaction with, the physical environment. Autonomy positively predicted ease of communication, job satisfaction, and wellbeing. The autonomy-communication finding supports SIT's argument that control has an important influence on workspace reactions (Oldham et al., 1995).

Interaction: Differential Outcomes for Employees

The findings highlight a phenomenon of differential relationships with the physical environment, with particular groups of employees reporting more positive or negative ease of communication under differing forms of office configuration and autonomy (in support of Hypothesis 3a). This finding is significant in supporting calls to consider individual

employees' needs and job design when designing workspace (Davis, 2019; Wohlers & Hertel, 2017).

Although the findings support Hypothesis 3a, closer inspection of the form of the interaction shows that the pattern of effects is slightly different to that which we hypothesized. We found general support for SIT, reflected in the higher ease of communication reported by groups with access to break-out areas and higher autonomy (see slope 1, Figure 2). However, we had expected these employees to report greater ease of communication within high proximity offices. Instead, our results show no significant difference for these groups regardless of the level of proximity (slope 1 in Figure 2).

The results emphasize the role of autonomy in understanding how certain groups of employees might differ in their response to similar open-plan offices. The greater ease of communication for employees with higher autonomy and access to break-out areas relative to those with lower autonomy but with break-out access (see slope 1 and slope 2 respectively, Figure 2) supports the observation from the design literature that it is high-autonomy employees who are most suited to and able to utilize break-out areas (Duffy, 1997; Laing, 2006). Congruent with SIT, it is likely that employees with higher autonomy are not only better able to manage social interference, but also to exert control over how, when, and where they work, utilizing different work areas and managing interactions in line with work demands. A lack of significant difference between higher and lower proximity for employees with access to break-out areas (slopes 1 and 2 in Figure 2) suggests that for these individuals, the benefit of break-out areas mitigated differences in proximity in the range observed.

SIT offers a lens through which to understand the discriminatory effects of physical proximity, break-out access, and autonomy. Differences in autonomy may explain the marked difference between the two groups of employees without access to break-out areas, who show

strongly contrasting effects of proximity and autonomy (slopes 3 and 4 in Figure 2). In the absence of a break-out area, our earlier reasoning would lead us to expect that higher proximity would mitigate the effect on ease of communication. A compensatory role of higher physical proximity is observed, but only for those employees with higher autonomy, most likely enabling them to regulate the interactions that occur around their desks or to shift the tasks that they work on to suit their surroundings (see the differential effects between the no break-out high autonomy and no break-out low autonomy groups, slopes 3 and 4 in Figure 2 and Table 4). In other words, proximity appears to compensate for a lack of access to break-out areas, where the employees possess the autonomy to manage the interactions occurring around them or to change how and when they engage in specific work tasks. Employees without the autonomy to manage the increased interactions associated with higher proximity conditions (c.f., Allen & Hauptman, 1987) reported lower levels of ease of communication (gradient of simple slope=-0.94, t=-2.20, p<.05).

Hypotheses 3b and 3c were not supported, suggesting that affective responses to workspace (job satisfaction and wellbeing) are not congruent with SIT-based predictions.

Implications for Research

Our study has addressed calls to extend SIT by applying it to more contemporary offices. We have demonstrated that SIT is able to accommodate a broader range of physical design aspects and reflect emerging workspace trends. Future studies could extend this to consider how configurations such as Activity Based Workspaces (incorporating a wider range of task spaces and hot-desking, Brunia, De Been, & van der Voordt, 2016; Wohlers & Hertel, 2017) might influence social interference.

Our findings have established that SIT is able to meaningfully predict variations in a broader range of individual outcomes than its proponents (e.g., Oldham et al, 1995) initially

envisaged. Specifically, we have demonstrated empirical support for the inclusion of affective wellbeing and communication as outcomes within the framework. This contribution changes the narrative and emphasis with regard to SIT. Traditionally SIT has been framed in terms of explaining negative responses to open-plan environments, with outcomes centered on withdrawal and dissatisfaction. Our study illustrates that contrasting outcomes may be experienced by employees and that social interference might not produce wholly negative responses. The framework provides a lens to explain and examine these varied outcomes.

We have also sought to test the underlying processes influencing responses to the physical environment (Ashkanasy, Ayoko, & Jehn, 2014; Morrow et al., 2012; Oldham et al., 1995), directly examining a central aspect of SIT, namely the role of control (examined through autonomy) in relation to the physical environment. While SIT offers insights into processes that might influence how employees respond to design features in the workplace (i.e., control and goals), there is a need for greater direct testing of the relative influence of these factors and their interaction with different combinations of workspace designs (Fried et al., 2001).

This study has reinforced the role of the physical environment in influencing employee outcomes - in particular the positive role of break-out areas within open-plan offices and the need to consider autonomy when exploring employees' responses to their environments. We confirmed the positive psychological and organizational benefits of moving beyond traditional open-plan offices to contemporary designs that include added task spaces (Bodin Danielsson et al., 2014; Heinzen et al., 2018; Wohlers & Hertel, 2017). Furthermore, we confirmed that researchers need to consider whether there are tipping points at which features of open-plan configurations no longer elicit tangible responses in employees. In our study, proximity exhibited no relationship with job satisfaction or

wellbeing. This suggests that, unlike in much of the existing literature evaluating changes from cellular to open-plan offices (Davis et al., 2011; Morrow et al., 2012; Wohlers & Hertel, 2017), such spatial features may have less of an impact on employees already used to working in such environments.

We provide further support for the need to consider attributes of physical work environments alongside job design (Humphrey et al., 2007) and to address the changing nature of work and work roles (Oldham & Hackman, 2010; Parker et al., 2017). Our findings demonstrate that office design should accommodate the needs of varying groups of employees, and that there is a need for synergy between physical and work design. This poses a challenge for further acknowledgement of the physical environment within existing management theory (Humphrey et al., 2007) in addition to requiring cross-disciplinary research (Davis, Challenger, Jayewardene, & Clegg, 2014).

Implications for Practice

There are a number of practical implications for managers and practitioners. The first is that companies wishing to support greater communication and enhance employees' work experience might benefit from investing in break-out spaces. The positive outcomes relating to access to break-out areas was consistent across all situations examined. Access to a breakout space was found to ease communication, as might be intuitively expected, as well as relating to higher levels of wellbeing and job satisfaction. Nonetheless, there is likely to be a trade-off. Do companies allocate space to individual employees (thereby reducing density and proximity) or to communal break-out areas? The calculus at present is unclear and further testing of differing spatial configurations is required. Our findings do indicate that break-out areas might offer wider benefits in terms of the quality of experience for employees (job satisfaction and wellbeing) that justify their investment. Job satisfaction and wellbeing have

been found to be predictive of job performance, turnover intent and absence (e.g., Carlopio, 1996; Judge, et al., 2001).

A second implication concerns the positive relationships between autonomy and ease of communication, wellbeing, and job satisfaction. Specifically, the results suggests that job design may offer a means to limit negative outcomes relating to open plan offices (e.g., greater potential for social interference) or to enhance the benefits of contemporary designs (e.g., enable employees to make use of task space). Managers could use job redesign as a strategy to accompany the design of new office space or as an intervention to optimize the experience for employees already in such environments.

Finally, the three-way interaction identified highlights the need to consider when space planning the nature of the work roles and tasks that employees are engaged in. While individuals with access to a breakout area reported positive outcomes, these were greater for some groups of employees than others. Accordingly, there is an opportunity to optimize workspaces further. As architects and designers have noted (e.g., Duffy, 1997; Turner & Myerson, 1998), the "best" office design is likely to vary for different groups, we can do better than a one size fits all approach (Bodin Danielson, 2019; Davis, 2019; Wohlers & Hertel, 2017).

Limitations and Future Research

We employed a naturally-occurring field study to evaluate contrasting features of contemporary open-plan office design with ease of communication, job satisfaction, and wellbeing. The study gathered data across a number of offices within a single organization and examined differences in their physical configuration. The study design allowed the complex nature of the physical environment to be analyzed and interactions to be identified, testing an extension to SIT. Data were collection within a single organization, which helped

to reduce potential confounding differences from organizational variables or subtleties in corporate design standards. However, some limitations should be noted. Generalizability could be enhanced if the study were replicated to test if the findings hold in other industries (e.g., legal services). The comparative nature of our study also precludes tests of causality or temporal ordering of variables. Future research could examine whether these findings hold over time and use quasi-experimental or time series designs (Grant & Wall, 2009) to test the causal pathways predicted by SIT.

Our study focused on differences in proximity and break-out access, there is the need to explore variations in the other physical features identified by SIT, together with extending this to consider further task spaces. Such research would help to build a body of knowledge in regard to the combined effects of spatial features. Our study has demonstrated that SIT is able to predict a wider range of outcomes than previously theorized. Future research could explore additional individual outcomes, particularly those that may be positively influenced by interaction with others (e.g., knowledge sharing or creativity). Autonomy was confirmed as an important element of SIT, however, its relationship with goal attainment was beyond the scope of this study. Future research should examine the interactions between autonomy and goal attainment or test alternative causal chains involving these concepts.

We employed self-report measures of ease of communication and wellbeing. It would strengthen future studies to complement self-report measures with other sources of data for outcome variables. For example, direct measures of communication using observation (e.g., Rashid, Kampschroer, Wineman, & Zimring, 2006), physiological measures of stress and wellbeing (see, Davis et al, 2011) or technologies to record proportions of work activities undertaken in different task spaces (see, Lahlou, 1999; Robinson, 2012). The use of other sources of data would permit validation checks on the ease of communication measure and

enable different types of communication to be explored (e.g., information seeking or knowledge sharing). It is possible that the ease of communication items could be interpreted more widely than intended, consequently, additional construct validity checks should be included as part of future research.

As noted previously, proximity was relatively high across both of our office conditions and this was the established norm for the organization studied. Replication of our study across office environments where there is a wider range of variation in proximity, or where employees are less accustomed to high proximity working, might enable direct effects of proximity on employees' reported outcomes to be detected (e.g., Brennan et al., 2002; Seddigh et al., 2015).

The large size of the functional and program teams, together with multiple overlapping group memberships, precluded team-level analysis within our study. The examination of team-level effects and contingencies has received little attention within the workspace literature. Shared identities, supervisory practices and related interdependencies might help researchers and practitioners to explain variations in occupant responses across similar offices. Methods relating to multi-level modelling and network analysis could be deployed by researchers with access to occupants in organizations using traditional team structures of similar size and in sufficient numbers (see, Salas, Cooke, & Rosen, 2008).

Studies of job design have largely neglected the relationship with the physical environment (Humphrey et al., 2007; Parker, Morgeson, & Johns, 2017). Future research should explore the interaction of contemporary offices and modern work. Use of techniques such as task or person-level assessments (e.g., Work Sampling Method) and data collection via portable devices (e.g., Ashkanasy, Ayoko, & Jehn, 2014; Robinson, 2010) would enable

researchers to develop a greater understanding of not only which groups of employees are best supported by different spatial configurations, but also the tasks that are supported.

Conclusion

Our study capitalized on naturally occurring variations in office design within a global engineering company to evaluate the relationship between physical proximity and access to break-out areas for employees with differing levels of autonomy on ease of communication, job satisfaction, and wellbeing. We extended SIT to explain differential outcomes within contemporary open-plan offices. We demonstrated the potential of this framework to be used as a foundation to engage in theory building to explain the complex relationship between employees and their physical environments. The results illustrate the trade-offs involved in the design of contemporary open-plan offices, as well as the potential to support communication and broader individual outcomes through the use of local break-out areas. We demonstrate that we must go beyond thinking of one size fits all in open plan and that employees might be affected by their office environment in different ways. Job design may offer an opportunity to enhance and support employees' experiences within open offices.

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Table 1: Distribution of sample across office conditions.

		Break-Out Access		
		Yes	No	
Proximity	High	177	80	257
	Low	81	68	149
		258	148	406

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Table 2: Means, standard deviations and intercorrelations among all variable

Variables	***M***	***S.D.***	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1. Sex	0.84	0.37	--									
2. Admin	0.18	0.38	-.39**	--								
3. Manager	0.22	0.41	.12*	-.24**	--							
4. Supervisory	0.32	0.47	.22**	-.18**	.56**	--						
5. Proximity	0.63	0.48	-.16*	.12**	-.05	-.08	--					
6. Break-Out	0.64	0.48	.04	.01	-.01	.04	.15**	--				
7. Autonomy	3.62	0.71	-.01	-.01	.17**	.17**	.03	.03	--			
8. Communication	3.62	0.90	-.03	-.05	.06	-.04	-.01	.14**	.21**	--		
9. Job Satisfaction	4.58	0.85	-.08	-.03	.09	.12*	.03	.14**	.47**	.44**	--	
10. Wellbeing	4.17	0.74	-.03	.08	.03	.05	.05	.16**	.33**	.28**	.54**	--

$N = 401$, $^{*}p<.05$, $^{**}p<.01$

Table 3: Summary of moderated multiple regression analysis for Ease of Communication

DV: Ease of Communication

IV's Beta	**Step 1**	**Step 2**	**Step 3**	**Step 4**
Sex	-.04	-.05	-.04	-.04
Admin	-.06	-.07	-.07	-.07
Manager	.11	.09	.09	.08
Supervisory	-.09	-.13*	-.13*	-.14*
Proximity (a)		-.04	-.03	-.02
Break-Out (b)		.14**	.15	.16*
Autonomy (c)		.21**	.09	-.02
a*b			-.01	-.01
a*c			.07	.27*
b*c			.09	.27*
a*b*c				-.29*
R^2 (%)	1.4	7.7**	8.3**	9.4**
ΔR^2 (%)		6.3**	0.60	1.1*

$N = 401$

IV = Independent Variables

*p<.05, one-tailed

**p<.01, one-tailed

N.B. All continuous IVs centered.

Table 4: Summary of tests of slope difference

Slope Difference	***t***
1 (Break-Out, High Autonomy) and 2 (Break-Out, Low Autonomy)	-0.98
1 (Break-Out, High Autonomy) and 3 (No Break-Out, High Autonomy)	-1.58
1 (Break-Out, High Autonomy) and 4 (No Break-Out, Low Autonomy)	0.39
2 (Break-Out, Low Autonomy) and 3 (No Break-Out, High Autonomy)	-0.54
2 (Break-Out, Low Autonomy) and 4 (No Break-Out, Low Autonomy)	1.43
3 (No Break-Out, High Autonomy) and 4 (No Break-Out, Low Autonomy)	2.07*

Note. Group numbers correspond with groups listed in Figure 2. Slope difference tests calculated with Dawson and Richter's (2006) recommendations.

*p<.05.

Table 5: Summary of moderated multiple regression analysis for Job Satisfaction

DV: Job Satisfaction

IV's Beta	**Step 1**	**Step 2**	**Step 3**	**Step 4**
Sex	-.13*	-.13*	-.12*	-.12*
Admin	-.05	-.07	-.07	-.07
Manager	.03	.01	-.01	-.02
Supervisory	1.29*	.07	.06	.06
Proximity (a)		-.02	-.01	-.01
Break-Out (b)		.13**	.15**	.15*
Autonomy (c)		.46**	.35**	.34**
a*b			-.01	-.01
a*c			.06	.08
b*c			.09	.10
a*b*c				-.02
R^2 (%)	3.2*	25.7**	26.2**	26.2**
ΔR^2 (%)		22.4**	0.6	0.0

$N = 401$

IV = Independent Variables

*p<.05, one-tailed

**p<.01, one-tailed

N.B. All continuous IVs centered.

Table 6: Summary of moderated multiple regression analysis for Wellbeing

DV: Wellbeing

IV's Beta	**Step 1**	**Step 2**	**Step 3**	**Step 4**
Sex	-.01	.00	.00	.00
Admin	.10	.09	.08	.08
Manager	.04	.01	.00	.00
Supervisory	.06	.01	.01	.01
Proximity (a)		.00	.01	.02
Break-Out (b)		.14**	.15*	.15*
Autonomy (c)		.33**	.23**	.19
a*b			-.02	-.02
a*c			.02	.10
b*c			.11	.18
a*b*c				.12
R^2 (%)	1.4	13.8**	14.3**	14.5**
ΔR^2 (%)		12.4**	0.5	0.2

$N = 401$

IV = Independent Variables

*p<.05, one-tailed

**p<.01, one-tailed

N.B. All continuous IVs centered.

Table 7: Summary of Support for Hypotheses

Hypothesis	Supported?
1a: Higher proximity positively predicts ease of communication.	Not Supported
1b: Higher proximity negatively predicts job satisfaction.	Not Supported
1c: Higher proximity negatively predicts wellbeing.	Not Supported
2a: Access to break-out areas positively predicts ease of communication.	Supported
2b: Access to break-out areas positively predicts job satisfaction.	Supported
2c: Access to break-out areas positively predicts wellbeing.	Supported
3a: Access to break-out area, high proximity, and high autonomy will interact to predict higher ease of communication.	Supported
3b: Access to break-out area, high proximity, and high autonomy will interact to predict higher job satisfaction.	Not Supported
3c: Access to break-out area, high proximity, and high autonomy will interact to predict higher wellbeing.	Not Supported

Figure 1: Conceptual Model and Hypotheses.

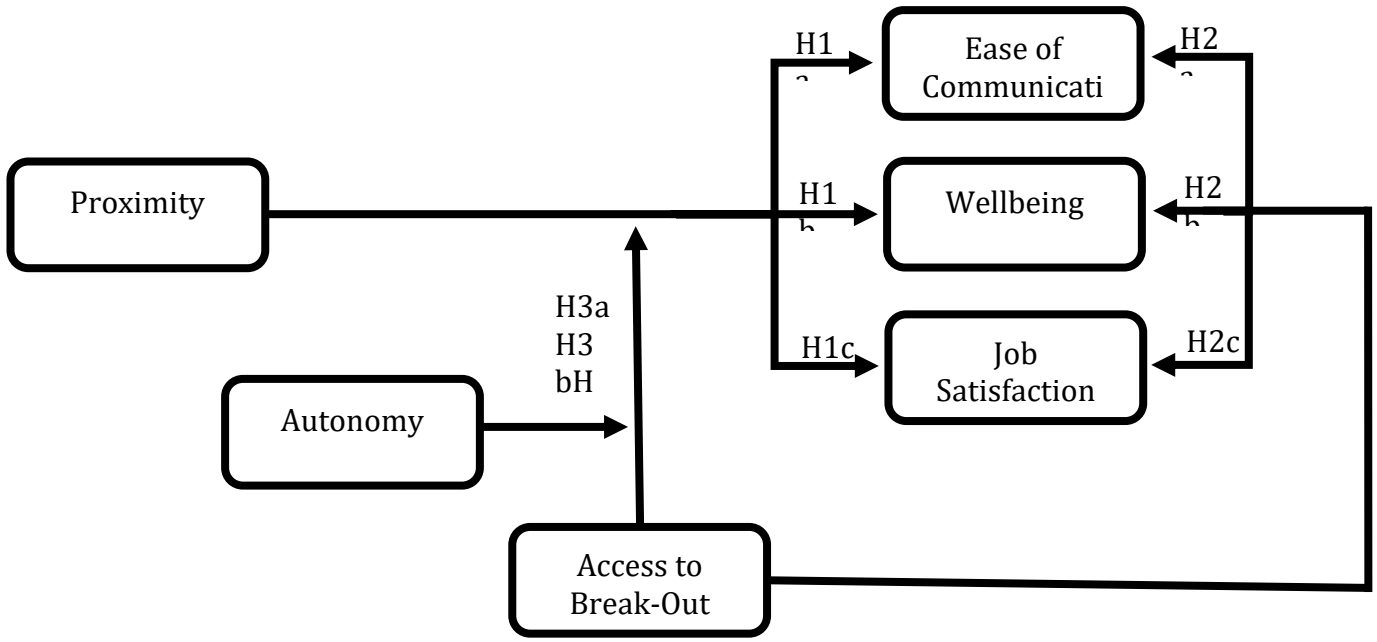

Figure 2: Plot of three-way interaction between Proximity, Break-Out Access and Autonomy with Ease of Communication level.