

Quantifying the Complex Adaptive Workplace

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Abstract *Despite well-publicised successes and failures, the evidence base for the impact of a workplace on an organisation's business performance remains small and confused. Theoretical perspectives are, with few exceptions, limited to matching physical environment to task. The 'edge of chaos' at a critical density of connectivity (Kauffman's K) between the agents in a network may explain how workplaces enable, or retard innovation. Formal rectilinear open plan offices are conceived as freezing occupants in a state of connectivity as low as traditional cellular designs. Offices without minimal acoustic or visual privacy (high K) may create chaotic stress and reversion as individuals seek to recreate safety. In between are offices known to have enhanced informal conversation between their occupants and resultant innovation. Do these represent edge of chaos conditions? The hypothesis can be justified by reference to examples. A first test of the hypothesis is reported identifying an interaction / disruption factor valid to varying degrees for all categories of work*

Introduction: New Workplaces Fact or Fad.

The term Facility Management (sic) was coined in North America during the late 1970's to describe a developing field of study into the design and management of workplaces and their impact on the business of organisations that occupied them. In crossing the Atlantic the same putative body of knowledge became known in the UK as Facilities Management and the original sense of workplace design came to be confused with the provision, and especially the outsourcing² of building support services, (Price, 2002a). Early commentators stressed a complex and 'ecological' stance on new workplace design (Becker, 1990; Becker and Steele, 1995) but the message has been largely lost and the current workplace debate focuses on 'open-plan' versus 'cellular' space (Haynes et al., 2001), retains neo-Taylorist overtones (Duffy, 2000), is uncritical and apparently unaware of the post modern organisational discourse (Cairns and Beech, 1999) without evidence of impact on all but the most mundane measures of productivity (Haynes et al, 2001) let alone a theoretical framework for understanding same. Facilities, as opposed to Facility Management has become a discipline, and industry, dominated by building operations and maintenance (Lord et al., 2002)

Yet there are well publicised descriptions of successes (Coutu, 2000), and of failures (e.g. Berger, 1999) and the suggestion, in a work of reasoned critique outside the main facilities literature, that physical space may be the most important, yet least appreciated, tool of contemporary knowledge management (Ward and Holtham, 2000)

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² 'Facilities' is the older term having been employed originally to describe the outsourcing of data processing activities from 1968.

As new management tools, or fashions (Abrahamson, 1996), gain a niche in organisational discourse they attract proponents, managers, consultants and academic groups among others, whose interests are served by the continued spread of a particular fashion. Organisations emerge whose existence depends on propagation of the fashion involved (Price, 1999). One measure of the process is the growth in the number of publications devoted to the subject as publishers, and authors, spot the new niche (Abrahamson, 1996; Abrahamson and Fairchild, 1999; Scarborough and Swan, 1999; Price, 2002b).

With some confusion of terminology between issues of workplace design, flexible working, and teleworking the trend may be seen in the current literature on workspaces. Occupiers are urged towards mobile or flexible futures. Perhaps even the continuation of the commercial office is in doubt (Bayliss, 1997; Becker, 1990; Becker and Steele, 1995; Bertin and Denbigh, 2000; Clements-Croome, 2000b; Duffy, 1998; Duffy, Laing, and Crisp, 1993; Eley and Marmot, 1995; Harrison, Loe, and Read, 1998b; Horgen et al., 1999; Laing et al., 1998; McGregor and Then, 1999b; Myerson and Ross, 1999b; Oseland and Bartlett, 1999; Raymond and Cunliffe, 1996; Stredwick and Ellis, 1998; Thomson and Warhurst, 1998; Turner and Myerson, 1998a; Verity and Shircore, 1996; Vischer, 1996; Wineman, 1986; Worthington, 1997; Zelinsky, 1998).

The argument for flexible offices has been well established with Becker (1990) and Duffy (1990) as the most noted pioneers. Offices or workstations are notoriously under utilised, even during normal working hours so their use by more than one person makes apparent economic sense. Different forms of work require different forms of space, so provision of same should raise effectiveness. Work is increasingly a series of formal and informal projects, requiring groupings of individuals for limited and variable periods of time. Space can facilitate such groupings; moving people but not fixtures.

At a more abstract level, modern organisations are increasingly perceived as ecosystems rather than machines: systems in which tacit knowledge is developed and exchanged through conversations, formal and informal. Space that encourages such conversations might speed up organisational learning. Knowledge management theory is beginning to regard the level of informal connection in organisations as an important part of the knowledge creation process (Palmer and Richards, 2000). Some degree of interaction in an office environment may be essential to enhance peoples' knowledge of the organisations they work for. Even call centres that have successfully introduced have found provision of opportunities for agents to visit 'the office' an essential part of the mix.

Yet the evaluation of workplace flexibility remains contentious (Vischer, 1999). Some go so far as to argue for a return to private offices (Olson, 2002). Independent academic studies (and they are few) are cautious. Cairns and Beech, (1999a; 1999b), while taking care not to "*seek to deny that any of the concepts of flexible working may be truly valid and applicable*", highlight the advocacy bias in many speeches and presentations on the subject. The revolution foreseen by the pioneers of FM has not materialised (Duffy, 2000) and the glittering prize remains out of reach for most office workers (Nathan and Doyle, 2002). Issues of organisational culture, foreseen by Becker (1990) remain under appreciated (Hörgeren *et al.*, 1999). Managerial attitudes are seen by those who have succeeded or failed with flexibility

initiatives as the single most common determinant of the outcome (Lupton and Haynes, 2000; Price, 2001b).

A fuller review (Haynes et al. 2001) and a working paper (Price, 2001a) can be found on the www.occupier.org resource. Our concern in this paper is to develop a theoretical stance which offers, we believe, a new means of explaining successful office designs, then to indicate, with early results, how that frame can be tested.

Towards a new theory

What went wrong?

Clearly some would criticise the question. If flexible office design is not the panacea it's proponents promised then, if anything went 'wrong' it was merely the attempt to implement changes that were inappropriate. Alternatively, as successful cases suggest, more innovative workplaces may stimulate more innovative work, while helping attract and retain more innovative workers. If so, then in the knowledge based economy such workplaces should indeed be a lever to improved organisational performance; Ward's (2000) and Ward and Holtham's (2000) '*most neglected resource in contemporary knowledge management*'.

Francis Duffy, recently (2000) reflected that the changes he and others anticipated twenty years ago have not come to pass.

"The skill of managing office space may have developed but the office environment itself remains very much as it was."

Duffy attributes the failure to conservatism by suppliers, to lingering Taylorism and associated hierarchical cultures in organisations, but most of all to a cost focus on the part of both Facilities Managers and design professionals.

"Programmes of research could have been initiated, using comparative data from cumulative case studies, to demonstrate the effectiveness, as well as the efficiency, of using the design of the working environment to achieve strategic business purposes."

Missing from this analysis is any theoretical framework concerning the impact of workplaces on the behaviour of those who use them³. The designer is still assumed to be an expert who knows what best suits the individual⁴. Even if Taylorist ideas are criticised, work is assumed to be something that can be planned and managed. Despite anthropological, Steele's (1988) 'caves and commons' (Hurst, 1995) and biological, Becker's (1990) 'workplace ecology', metaphors in the early workplace literature much of the debate is still framed in terms of 'open-plan' versus the private office. Design is still predominantly considered as a rational rather than an emergent

³ The best known, Duffy's own model of hives, dens, cells and clubs imposes its own solutions arguing that the design of the office matches the degree of autonomy granted the worker and the interaction demanded for the tasks they are required to carry out.

⁴ For a notable exception see Hörger *et al.*, (1999) who advocate 'process architecture' an engagement by the designer with the unwritten rules of the organisation.

process. An epistemological stance which sees management and design as distinct activities (Leaman, 1992) still predominates in the professions concerned.

Beyond the rationalist paradigm

Parallel developments in evolutionary approaches to organisational sociology (e.g. Hull, 1988; Aldrich, 1999) and Complex Adaptive Systems theory (e.g. Waldrop, 1994; Price and Shaw, 1998; Maquire and McKelvey 1999; Pascale et al. 2000) are gradually coalescing to offer an alternative paradigm of organisations and their 'management'. They may be less intentional creations in which a dominant group exerts power over subordinates and more emergent phenomena maintaining boundaries. While they keep a niche in a social and economic ecosystem organisations replicate particular schemata or memplexes (Price, 1995; Lane, 1996; Gell-Mann, 1996; Carney and Russell, 1997; Price and Shaw, 1998; Blackmore, 1999). The debate, and its implications for management practice, can be conceived as happening along a spectrum of explanations of what organisations are and how they should best be managed. One end of the spectrum is the traditional 'mechanical' perspective. Management is a rational process of setting desired parameters, planning how an organisation will perform, and ensuring compliance. The other sees organisations as 'living' systems, not just metaphorically but literally. Management is the act of creating contexts from which new knowledge and new results emerge. Particular events and actions are bound to be unpredictable and performance is judged in terms of whole system outcomes, not inputs.

Equivalent debates can be found in other branches of social science. Economics is developing, some would say redeveloping, an 'evolutionary' approach (e.g. Loasby, 2001) and behavioural research is even beginning to command attention in property valuation (Diaz, 1999). Psychology wrestles with the extent to which behaviour is 'hard-wired' or socially constructed (Ashworth, 2000). However, despite the calls of some pioneers (especially Becker, 1990) most workplace research (such as there is) has stuck within a narrow, rationalist framework where hours saved or sheets of paper processed are seen as measures of productivity (Haynes et al., 2000). It is the authors' hypothesis, based on this review that pushing harder and harder at what has not worked is unlikely to succeed. We need research, which starts with a different underlying paradigm, if we are going to reach any understanding of the interrelationship between workplace, organisational culture, and business results.

The alternative may be found in the emerging synthesis of evolutionary and complexity perspectives. There is obvious resonance between the complex systems perspective and the ecological view of workplaces proposed especially by Becker. Such evidence as does exist for success stories points to links between a critical mass of informal interaction and faster knowledge creation (Haynes et. al., 2000). Can studies that start with that as a hypothesis explain the contribution of workplace to organisational success?

Connectivity in the workplace

Kauffman's (1993, 1995) NK networks and the edge of chaos have become one of the enduring messages, or metaphors, of complexity. In essence, according to his simulations, the behaviour of a system of N agents, each of which can have at least two states (e.g. on /off), depends on K : the proportion, or number, of agents whose current state influences the change of state of another. With low values of K systems are 'frozen' to a particular state. As K approaches 100% (or $N-1$), behaviour becomes completely erratic with no sustained innovation. Maximum adaptation and emergence of new forms occurs in the narrow zone of critical connectivity (Figure 1): labelled 'The Edge of Chaos'. The term gained its niche in organisational commentary, but has not, at least so far as search of current literature has revealed, been used to analyze office environments⁵.

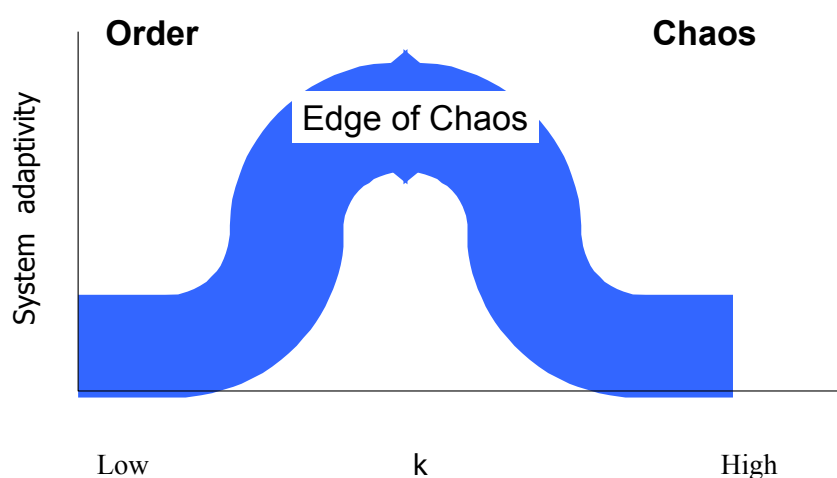


Figure 1. The concept (modified from Kaffman, 1993, 1995): A zone of maximum adaptability occurs at some critical density of connectivity. Can offices be visualised in these terms?

Much of the literature on 'new ways of working' is framed in terms of open-plans and hot desks versus traditional cellular offices. Yet many open-plans reproduce rectilinear layouts in which individuals or small groups are provided with, or create for themselves, spaces that are as enclosed and private as the prevailing environment permits⁶. They reflect a pattern towards the mechanical end of the spectrum. Meetings are conceived as formal events for which people go to a meeting room, not part of the routine of work. 'K' would seem to be low and not changed by any move from one to the other.

Sustained examples of offices in which 'K' approaches $N-1$ are harder to find, perhaps because of individual reactions. A total open plan, with no acoustic privacy and an expectation of every worker at his/her workstation most of the time might fit the bill. Is this why certain call centres suffer such high rates of agent attrition, and its

⁵ Ward and Holtham's (2000) conception of knowledge management and knowledge environments as Complex Adaptive Systems comes closest but ultimately goes in a slightly different, albeit interesting direction. They cite Swedish research by Tornquist (1983) as arguing for creative milieux having a certain density of communication with a kind of overcrowding and chaos.

⁶ Space prevents the inclusion of examples here. They have been illustrated (Price 2002c) in a longer version of the theoretical part of this paper and included in the conference presentation.

economic consequences (Citex, 1999)? More usually staff perhaps build their own 'walls', again using furniture but typically in a more random manner. The organisation reverts to a more disorderly but equally rigid arrangement.

An online case study (Lake, 2000) of a success story in flexible working, one which provides a variety of work spaces and has sets of workstations used by different teams on different days shows the difference. It was one in which the design team acted as facilitators rather than experts (pers. comm. to IP 1999) and since its implementation the users have gained a reputation for innovation with their customers. Connectivity, while people are in the office, is high but home, and various 'caves' offer privacy. Visually it projects an image that is somewhat disordered but not chaotic or frenetic. Is it at the edge of chaos⁷?

Connectivity can also be seen in the alternative debate on new workplaces: the one which distinguishes 'caves and commons' and private rows (Steele, 1988; Becker and Steele, 1995; Hurst, 1995; Hargadon and Sutton, 2000) rather than open plans and private offices. In 'caves and commons' designs individual workstations - or offices - surround or share informal common space in which frequent informal interaction occurs. Work is a system of fluid conversations and workers move to whatever environment is needed for a particular conversation, or simply find themselves exchanging information by chance⁸. Again some critical mass of connectivity is achieved⁹. The Complex Adaptive Workplace perspective would argue that caves and commons sustain a higher degree of connectivity.

Research

Hypotheses

The above model leaves the following to be hypotheses to be tested

1. New Workplace Initiatives succeed when they enable some critical density of spontaneous interaction. Too much and the distractions outweigh the benefits. Too little and benefits are not seen. That critical density may vary with sector and type of work.
2. Realising the success will depend on the culture of the organisation and will be greatest in organisations who have most successfully adopted 'new' managerial patterns. Contrast Turner and Myersons' (1998) mould breakers, those who have succeeded because they challenged, or were unconstrained by, the traditional patterns of a particular sector, from their modernisers, those who changed the office but not the thinking that went with it. The success to be realised will be a factor of the

⁷ Our own offices in FMGC (also profiled online) are designed on similar principles.

⁸ The view that professionals get 80% of their ideas through casual interaction (Liebson, 1981) has been much repeated but I have not found it further researched.

⁹ Undoubtedly other factors, especially culture and management attitude (Haynes and Lupton, 2000; Price, 2001c) are important. Turner and Myerson (1998) refer to 'modernisers', corporations who have moved to fashionable new offices but where *"Staff shuffle uneasily down foliage filled avenues unsure whether sitting and chatting to a colleague over a cappuccino on a designer bench will be interpreted as slacking or having an informal meeting"*

extent to which 'new' cultures are a contributor to relative organisational success. Those who have implemented new office and workplace initiatives without changing old cultures will see less value (and perhaps negative returns) from the investment.

Methods

Where studies of occupants perceptions of their office environment have been published they have tended towards either a purely positivist occupier survey or to a blend of such surveys with either physical or cost based assessments of building performance (Bottom et al., 1999; Lorch, 1999). Phenomenological, or at least phenomenologically leaning, studies of workspaces or the interplay of workspace and culture are only beginning to appear (Hörger et al., 1999; Lupton and Haynes, 2000). Observational research is conspicuously absent from the 1990's literature (Haynes et al. 2000). In part the problem may reflect the multi-faceted nature of FM research, blending as it does the research traditions of economics, sociology, building physics and psychology. The hypothesis, expressed mathematically, is that:

Innovation = f (commonality, culture, connectivity)

Fully testing such a model is clearly multifaceted and requires, *inter alia*, analytical tools for space classification, assessment of work cultures, and the elusive 'holy-grail'; a means of measuring the rate of knowledge creation in organisations. Price (2001, 2002c) has a longer discussion). An opportunity to assess the possible role of connectivity, was however provided when, during work for FMGC's Local Government Research Forum, we were asked to develop an indicator for assessing the impact of office facilities on productivity.

In doing such research, which is almost inevitably questionnaire based for reasons of practicality, analogies can be drawn from the literature on customer expectations and quality (Robledo, 2001) where one school, the disconfirmationists, regard importance and satisfaction as independent variables, hence SERVQUAL (e.g Parasuraman et al. 1988). In contrast perceptionists would hold the two to be simultaneously measured by questions of relative performance; Cronin and Taylor's (1992) SERVPERF.

Previous evaluations of office environments have tended to a disconfirmationist approach: i.e. have sought to measure the expectations of occupiers and their satisfaction in separate instruments. In the process links to productivity have become indirect. We opted instead for a perceptionist approach devising a research instrument which asked respondents to assess their perceptions of 27 variables on their individual productivity. The questionnaire provided scope for each to be assessed on a five point Likert scale from very negative to very positive. A series of categorising variables sought information on the individual respondents in order that results could be analysed by job type. Questionnaires were distributed in 27 Local Authority offices, introducing the possible bias in that participating Facilities Managers were volunteers. A total of 996 completed returns equated to a 22.9% response rate; acceptable in work of this kind (Hussey and Hussey, 1997).

Initial Results

Overall a Cronbach Alpha of 0.9485, pointed to high internal consistency and indicated reliability of the test instrument. A correlation matrix revealed a substantial number of correlations greater than 0.3 and a commonalities table showed 89% of commonalities scoring more than 0.5. These and a significant Bartlett test of sphericity all pointed to responses from a population of independent variables suggesting Factor Analysis as an appropriate analytical tool.¹⁰ A Principal Component Analysis was chosen as we aimed to determine the minimum number of factors needed to account for the maximum identifiable proportion of the variance in the original data set.

Interpretation of factors is ultimately subjective (Hair et al., 1995) with a trade-off between number and variance explained. In the event we settled on 7 (Table 1, Figure 2), explaining 69% of the variance. Two distinct groups can be recognised, the tangibles and the intangibles, corresponding closely to the McDougall and Hinks' (2000) distinction of service and socio-spatial conditions. Tangible components, environmental services, office layout and perhaps 'flexible space' relate directly to the individual and physical environment and are similar to those revealed in earlier studies (e.g. Leaman and Bordass, 2000). The components 'disruption' and 'interaction' appear to point to more intangible or psychological factors; indeed they may be an insight into the social construction of individual offices (see below). 'Comfort' verges more to the tangible, as at first glance does the factor 'informal interaction points' though the two items involved are perhaps the commonest sites of informal conversation. Where the factor extraction set is reduced the two items concerned load with other interaction factors.

Factor	Variables Loading	Cronbach -alpha
Disruption	Interruptions, crowding, noise, privacy, overall atmosphere	0.8478
Environmental services	Ventilation, heating, natural lighting, artificial lighting	0.8037
Office layout	Personal storage, general storage, work area, desk, overall office layout, position of colleagues, circulation space	0.8469
Interaction	Social interaction, work interaction, physical security, creative physical environment	0.7943
Flexible space	informal meeting areas, formal meeting areas, quiet areas	0.8469
Comfort	Décor, cleanliness, overall comfort	0.8690
Informal interaction points	Position of equipment, refreshment areas	0.5726

Table 1 Loading of variables with Principal Component Extraction at seven. Cronbach Alpha reliability scores for each factor are shown. Factor names (first column) were assigned by the authors.

Cronbach Alpha coefficients were calculated for each factor, and as can be seen from Table 1 support the robustness of most. The component 'Informal Interaction

¹⁰ Factor Analysis can of course be criticised on the philosophical ground that it produces results whether or not what is revealed has real meaning.

Points' has a relatively low coefficient which we take as an indication of heterogeneity in the sample and are investigating further.

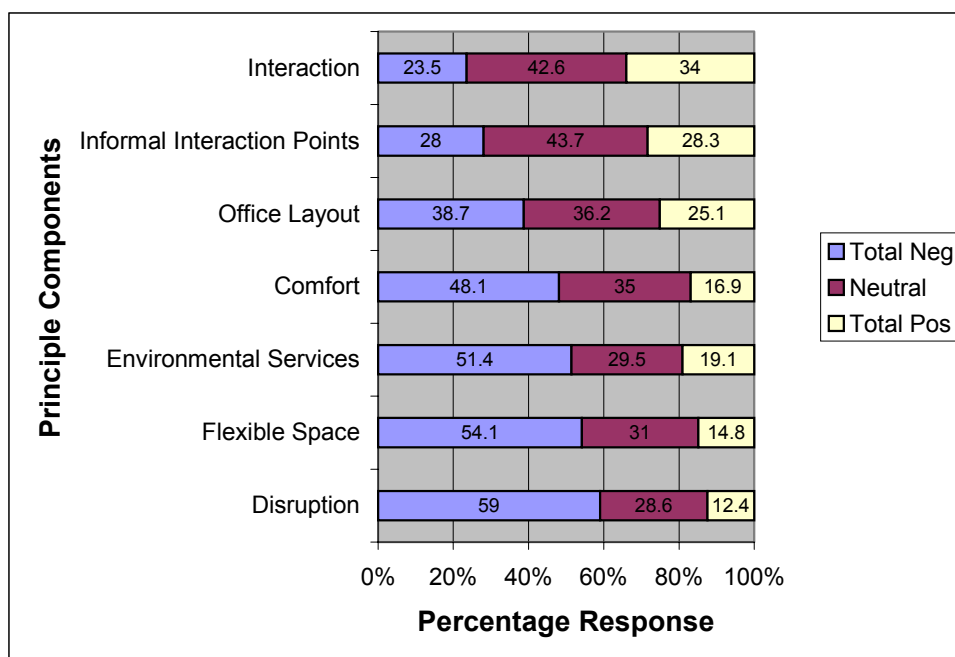


Figure 2. Overall ratings of the perceived impact of different factors on productivity

Figure 2 summarises the overall responses for each factor. Total Negative and Positive scores combine scores for two scale categories each. It is immediately apparent that the interaction factors are seen as scoring more positively whereas disruption scores most negatively. We have not yet been able to examine the 'flexible space' factor in follow up interviews but, given the sector, we suspect that respondents are reacting to the lack of such space and the resulting disruption, or possibly to a 'meetings culture'.

More generally the factors suggest a positive effect, on perceived productivity, of interaction, and a negative effect of disruption. While not surprising, and consistent with the inferences drawn above from the literature, these results do suggest that conventional occupancy analysis, which has historically tended to concentrate on the tangible may often have failed to examine the more important influences of office design on productivity. One important exception (Olson, 2002) likewise identifies the ability to do distraction free work and interactions as the two biggest factors impacting individual performance, team performance and job satisfaction. Olson however draws the conclusion that private offices are superior to 'open plans' but appears to equate open plans with rectilinear cubicle plans, ignoring completely alternative designs.

We by contrast would argue that the interactivity to disruption ratio appears compatible with the edge of chaos model. Too little of the former (order) and productivity, as measured by individual perceptions, suffers. Too much of the latter (chaos) and the negative effects of disruption dominate.

The research instrument also sought to classify responders according to their gender, type of work and mode of working. Investigations continue to examine the

validity of the above factors according to different categorisations, particularly the mode of working. Here the best known, in the UK at least, is Duffy's / DEGW's characterisation of four groups (e.g. Laing et al., 1998) according to the variables interaction and autonomy, defined as:

***Interaction** is the personal face-face contact that is necessary to carry out office tasks. As the amount of interaction increases, there is more pressure to accommodate and support such encounters.*

***Autonomy** is a degree of control, responsibility, and a discretion each office worker has over the content, method, location, and tools of the work processes (Duffy, 1998 p. 60).*

and producing the categories of individual process, team process, concentrated study and transactional knowledge work. In order to recreate the four different subsets of this matrix, the questionnaire asked:

- What percentage of time do you spend with Colleagues?
- How much flexibility do you have to work where, when and how you wish?

The first question aimed to establish the amount of interaction the individual has with their work colleagues when they are in the office and offered a choice of percentage ranges.. The second aimed to establish how much autonomy the individual has with regards to how they work with possible answers on a five point scale from very low to very high. The total dataset was then split into the corresponding subsets using the criteria shown in Table 2.

Way of Working	Flexibility (Autonomy)	Time with Colleagues (Interaction)	Sample Size
Individual Process	Very Low-Average	< 60 %	418
Group Process	Very Low-Average	> 60 %	302
Concentrated Study	High-Very High	< 60 %	184
Transactional Knowledge	High-Very High	> 60 %	93

Table 2 Ways of Working criteria adopted for this study

Column 2, in Table 2, allows the data to be split using the variable flexibility, i.e. autonomy. Therefore people working in individual process or Group Process work have very low-average amount of flexibility as to how, when and where they work. However people working in the concentrated study and transactional knowledge modes, have a high-very high amount of flexibility as to how they work in the office. Column 3 splits the data by establishing the amount of interaction an office worker has with their colleagues. People working in the individual process and concentrated study modes spend less than 60 per cent of their time working with colleagues. Alternatively the people that have the work methods Group Process and transactional knowledge spend more than 60 percent of their time working with colleagues. The final column, in Table 2, represents the sample size that corresponds to the appropriate way of working.

Having created the four comparable subsets; a factor analysis was undertaken for each subset to establish if unique factors are created for each subset, or if the factors

created in the total subset are reproduced in the subsets, thus supporting the validity and the generalisability of the original factors. Since this part of the research process is more confirmatory, then each of the new ways of working subsets was analysed with the factor analysis convergence model set at seven factors (Table 3).

Component	Ways of Working			
	Individual Process	Group Process	Concentrated Study	Transactional Knowledge
Disruption	0.8115	0.8880	0.7590	0.8345
Comfort	0.7111	0.8927	0.8664	0.8721
Flexible Space	0.8073	0.8443	0.8579	0.8789
Interaction	0.8115	0.8442	0.8547	0.9071
Informal Interaction Points	0.4913	0.6703	0.7916	0.691
Environmental Services	0.7989	0.8552	0.7764	0.7784
Office Layout	0.8535	0.8534	0.8095	No Component

Table 3 Component loading and reliability (Cronbach alpha scores) for staff reporting engagement in different modes of working

The same components load in each category, with the exception of the office layout factor for those who report high levels of autonomy in where they work: i.e. are likely to be mobile. Note however the strong correlation for this group in the interaction factor. The test reported examines reliability: i.e. the correlation between responses of randomly split portions of the sample. It does not measure importance – further examination is planned – but does indicate a high uniformity of view. In general the reliabilities are high for all factors and work types though the impact of Informal interaction points appears to vary more in perceived significance, especially for individual processors. At this stage we take the results as encouraging support for the validity of the constructs identified.

Future Work

Having validated the responses work continues to investigate difference in importance between different groups of workers. Spider plots (e.g. Figure 3) provide a potential tool to calibrate individual offices on the interaction / disruption ratio. We have noticed, comparing scores returned in individual offices, apparently significant differences in both factors but calibration studies continue. The opportunity to conduct statistical tests of the differences and compare with designs and any cultural factors has unfortunately not yet arisen. The importance of such studies is obvious. We are also seeking opportunities to test the results suggested here in other office based sectors, and to integrate such testing with other forms of spatial and sociocultural analysis. Meanwhile the results seem to provide evidence supporting both the informal view that what counts in offices is casual interaction, and the potential for modelling same using tools from complexity science.

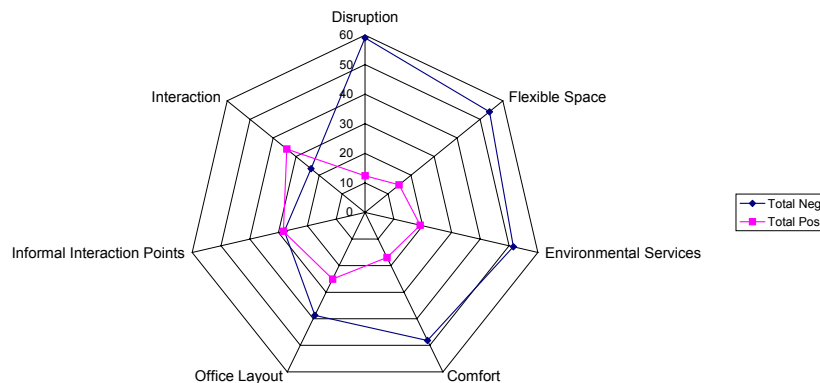


Figure 3. Spider plots of average scores on the 7 components for all offices in the survey

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