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Organising design in the wild: locating multidisciplinary as a way of working

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The workplace ecology of a multidisciplinary design team is studied to better understand how design work is organised in the wild. Reported is an ethnographic account of the events and practices that were seen, in patterned and subtle ways, to organise the design work for a project. Design events and activities were distributed in nested contexts throughout the office setting. The design work was seen to be planned, self-organised and coordinated through a series of practical actions and events that occurred in different locations. There was no single, identifiable event, interaction or communicative medium in which the coordination of the design work occurred. From these insights, *multidisciplinary* is proposed as a way of organising design work that cuts across some design interfaces. This way of procuring design services is contingent on the appointment of a design firm with multidisciplinary expertise, in an arrangement where the design work is undertaken collaboratively in a co-located setting with underpinning information systems.

Keywords: design practice; design coordination; co-location; workplace studies; ethnography

Introduction

At a point in time when technologies that support distributed working are pervasive, being able to justify the space and places for co-located working is increasingly important. Design service organisations make strategic decisions: in the place of work for design teams, the configuration of workplace settings and the information systems that support collaborative work. These decisions are complex, multifaceted and are interwoven. These are design management¹ concerns that impact the ways that design services are delivered and essentially the competitive performance, sustainability and the survival of a firm (Emmitt, 1999, 2007). It is a particular mode of design service delivery, *multidisciplinary* that is detailed in this article, to reveal some of the routine, yet significant practices in the workplace that organise the design activities for a multidisciplinary design team.

Complex relationships exist between the organisational design of firms, the structure of the construction sector and the configuration of work in project-based organisations (Bresnen, 2005). Increasingly construction projects are configured as globally distributed design teams and there is a trend towards mega-scale international conglomerates of design service provider organisations (Emmitt, 2010, p. 18; Winch, 2008). This distributed way of working is possible

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given the multiple information systems that underpin e-business and commerce and the collaboration technologies, groupware and digital tools that support design work specifically. Given the potential for networked collaborative work, the procurement of design services has advantageously explored the outsourcing of design work internationally and the export of high-value design services to global markets (Tombesi, Dave, Gardiner, & Scriver, 2007). To competitively provide design services the local and global are linked. Decisions concerning the location in which design work is undertaken and then how it is organised and coordinated both within and between settings are complicated, in a trade-off between distributed socio-technically mediated interaction and social interaction that takes place in person.

Given that collaborative work over-distance, mediated by information and communication technologies is feasible, what then are the merits of design delivered as a multidisciplinary service in a co-located setting? To examine this, the working practices of a multidisciplinary design team are studied in their workplace settings to draw attention to the subtleties of some routine practices and how these are instrumental in organising the design work for a project. In particular, it is the interplay between a location and the activities that take place there that are brought into focus, to illustrate how some routine practices feature in the organisation and coordination of design work. This article draws attention to multidisciplinary as a particular way of working to show how the design ecology that is the setting, as well as the activities and practices that take place there are seen to be intricately interwoven.

The paper is structured first outlining previous research that studies social interaction in design team meetings. The background to the data collection and the methodological orientation of the research are then introduced, followed by an account of the ways that design work is organised and coordinated in this multidisciplinary design practice.

Routine attention to design meetings

The organisation of the design activities within a multidisciplinary design team take several forms and interleaves activities within a design organisation with the production of design information for a project. Design meetings are important events in achieving this for several reasons. They are part of a routine way of working and the everyday life for a project and as patterned events feature significantly in the organisation of design work. Design team meetings are the locus for conversations between designers with different knowledge and expertise and are events that are organised specifically to discuss the design (Cross & Clayburn Cross, 1995). Design meetings often provide a setting for the members of a design team to meet in person, to talk in face-to-face situations (Emmitt, 2010; Emmitt & Gorse, 2007; Gorse & Emmitt, 2007; den Otter & Emmitt, 2007). Indeed, the analysis of design teams interacting in meeting settings has received much research attention (Emmitt & Gorse, 2007; Kleinsmann, Valkenburg, & Buijs, 2007; Luck, 2013; Maier, Eckert, & Clarkson, 2009; McDonnell & Lloyd, 2009). This interest in meetings is unsurprising, as these are project events that can be easily defined and data collection can be specific and prescribed. There are different types of design meetings and the name of a meeting type, the project stage, the people present and chairing meetings are known to differ (Foley & Macmillan, 2005). Analyses of the patterns of interaction in meetings have reported on the more dominant parties speaking most in meetings at various project stages (Austin, Steele, Macmillan, Kirby, & Spence, 2001; Foley & Macmillan, 2005; Hugill, 2004) and the informal socio-emotional interaction that accompanies task-based communication in meeting settings (Gorse & Emmitt, 2009). On occasion events that have already happened on a project are recounted as stories at a meeting and a local project history unfolds as a project progresses (Lloyd, 2000).

The settings where design team meetings take place will vary from project to project. We are designing buildings at a time when there is choice in the media used to work collaboratively and

in the medium in which design content is created. We have technologically mediated support for synchronous design collaboration in remote situations (e.g. shared building information modelling model), as well as numerous asynchronous modes for information sharing (Emmitt & den Otter, 2007; den Otter & Emmitt, 2007). Meeting in person is not always feasible, for example, when working in design teams that are geographically distributed. The use of video-conferencing tools and online conversations, augmented with desktop sharing functionality are increasingly part of the communicative repertoire used on projects. The trade between the time, effort and expense in travel to a meeting are reasons that are often cited for not attending (Emmitt, 2007, p. 244) or choosing to arrange meetings using remote-synchronous communication tools, even though the richness of communication in face-to-face interaction is well documented (Dixon & Panteli, 2010). Although design team meetings have received much research attention it is not only at meetings that design activities are discussed and organised. This research studies what it is that happens in workplace settings, especially in and around design meetings, to justify meeting in person now that remote collaboration is both feasible and ubiquitous. In doing this we draw attention to the kinds of interactions that take place in the workplace and begin to probe the characteristics of these and how they constitute a design event. To study this first the research design, the data and methods are introduced.

Background and methods

A multidisciplinary design practice is a perspicuous setting to study the organisation of design work in the everyday workplace settings, where design work happens. The materials on which these observations are ground were gathered from a multidisciplinary design practice based in the UK, which provides consultancy services to the architectural engineering and construction and major infrastructure sectors internationally. The organisation we examine works in an office building designed to a British Council for Offices specification in a building that they designed and has won several awards. Providing a workplace environment that enables increased collaborative working was a motivation for relocating to this building several years ago. Before occupying this building, the organisation's workspaces were organised by design discipline. This is a workplace configuration that is inclined to encourage silo-working and thinking, where the information generated by one expertise is 'passed over the wall' to another and is considered to exacerbate sequential and not collaborative design work.

The building they currently occupy was designed with an open plan floorplate. There were shared facilities on each floor, including a kitchen area and printing services, which meant that wandering around the open plan space was not unusual. The workspace had the feel of a creative design studio, in many ways akin to design studios in schools of architecture. Everyone had a dedicated workspace with a computer and some near-proximal, territorial 'layout' space for drawings and other materials. The design studio in several respects acted as a physical manifestation for a matrix organisation. By organising the workplace around project-based groupings rather than disciplinary expertise serendipitous, cross-disciplinary interactions took place in this setting, as well as interactions specifically for work-related reasons. The physical configuration of the workplace provided opportunities for routine, everyday interactions to happen between people, natural encounters to get to know colleagues as people instead of viewing less well-known colleagues by their design discipline stereotype. An awareness of colleagues' competencies and characteristics were also raised over time as people worked on different projects in different project-team configurations. In a large organisation, it was both the workplace configuration and some very pragmatic decisions aligning design expertise with project resource that encouraged people to know each other better and not just colleagues from the same design background.

The nature of the fieldwork was ethnographic with the research team gathering data, video-recording meetings, talking to the design team, observing and making field notes as activities happened in the workplace (Garfinkel, 1967; Heath, Hindmarsh, & Paul, 2010; Luff, Hindmarsh, & Heath, 2000). This took place intermittently, over a six-month period, spending over 100 hours attending all the planned design team meetings, with designers in the studio and other workplace locations. Given this open access the researchers had ample opportunity to become familiar with this multidisciplinary design team's ways of working and how the activities observed fit within the wider organisation. A rich body of data and experiences were available to draw from including conversations with people in various workplace settings, as well as the more substantive and enduring recordings of interactions that were available for repeated review. The data are regarded as naturalistic, as the activities on a 'live' project are reported at events that would have taken place irrespective of whether the researchers were present. In keeping with the observer's paradox (Labov, 1972, p. 209) however, we can never know whether what was observed would have been different had a participant observer not been present. These data permit focus on the ways that the design ecology was produced in the situated activities and practices in the workplace. Design in the wild was experienced, as it was taking place.

The design of one project was shadowed in particular, studying the activities of a design team longitudinally as the scheme progressed from the early design stages, Royal Institute of British Architects stage B through to detailed design, stage C+. An advantage of this approach was that the team's design practices over a sustained period of time are reflected in the data. The design concept was developed for the project, then outline proposals for architectural, structural and building services systems were prepared in increasingly finer-grained detail and the coordination of these multiple design inputs was crucial to progress the scheme. It is significant in this dataset that all the design disciplines appointed for the project were employed by the same organisation. In this respect, the research observed the organisation and coordination of design activities across design disciplinary boundaries within an organisation. These are management concerns that can be traced back to Lawrence and Lorsch (1967). A characteristic of this data is that it represents the organisation of design work for an inter-disciplinary design team within a multidisciplinary design organisation.

The organisation of the design work was studied informed by workplace studies and ethnomethodological studies of work, where the actions and practices of people as they go about their routine activities are examined closely (Garfinkel, 1967; Heritage, 1997; Luff et al., 2000). With this form of analysis, the mundane, practical actions that organise everyday life are remarkable. The distinctive character of this multidisciplinary design firm and the way that they organise their design work is evident by studying situated actions at specific moments in time as well as how patterned actions provided a routine order to their work. It is in these 'small ways' that people locally recognise and reproduce the organisational location of their actions and these are noteworthy. This orientation to fieldwork is attentive to the setting in which social interaction takes place and how the activities that take place are seen and are understood (Luck, 2014). This builds on studies of ecological orbits and huddles (Goffman, 1965) knowing that the way that systems interact within a setting are intrinsic to the survival of an ecosystem, in this case for a multidisciplinary design practice to be competitive in an international environment.

Location-based working is studied within this multidisciplinary design organisation. This is examined by offering a mirror up to the seen but taken for granted, as well as some less reported activities and practices in the workplace that organise the design work. The research team brings particular expertise to this, including practical experience in the design of workplace environments, research expertise in the evaluation of office workplaces and the lived experience of working in design practices. This expertise is acknowledged to bring an awareness of the practices that are more routine and those that are novel in design firms. Presented here is an account that

characterises the design interactions in different workplace settings for this organisation. This approach is different from studies of the design ethos of firms, which describe workplace practices in less detail (Carolin & Duffy, 2005; Lawson, 2008). It does support renewed interest in understanding how the spatial configuration of workplace settings impact on the organisation of work (Beyes & Steyaert, 2012; Laing, Jaunzens, Duffy, & Willis, 1998; Meusburger, Funke, & Wunder, 2009).

Interaction in the workplace

The design team meetings and other interactions when the design of a scheme was being discussed took several forms in this firm. This brings into question what we mean when we talk about ‘design meetings’ and whether previous research is necessarily reporting on the same phenomenon. Is it the location, the presence of designers at an event, or something else that constitutes some forms of interaction as a design meeting? Furthermore, just what is it that makes some interactions in the workplace remarkable to progress the design of a scheme? These are categorical concerns that are addressed in this article by presenting a characterisation for each of the different forms of workplace interaction observed: (i) design co-ordination meetings, (ii) improvised meetings, (iii) design workshops and some and (iv) interactions in the design studio. There were other types of events that routinely took place in this organisation that are not reported, for example, strategic management meetings, although they were also important for the smooth running of the organisation. Characterisations for each of the specifically project-oriented interaction events follow.

Design coordination meetings

The design meetings that were held on a routine basis were the design coordination meetings. The design of the project was progressing at a fast pace and design coordination meetings were usually held at weekly intervals (although the frequency of the meetings did vary dependent on the project’s progress). These were organised events, for a planned date when the design team met in person. Design coordination meetings were held in a meeting room within the building (Figure 1) and a



Figure 1. A design coordination meeting.

room booking was made in advance. An agenda for each meeting was circulated by email beforehand, minutes were taken, either by the design manager or the project administrator, and a date for the next meeting was set at the end of each meeting.

Design coordination meetings were chaired by the in-house design manager and attended by the lead designer from each of the design specialisms for the project. The core people present at these meetings were: the in-house design manager, a structural engineer, mechanical/electrical services engineer, project architect, quantity surveyor, landscape architect and Building Research Establishment Environmental Assessment Methodology consultant, and on occasion other members of the team joined these meetings. At these events, people used pens and notepads and referred to copies of the last meeting's minutes. Noticeably, there was limited reference to a design programme, although the design manager was monitoring progress against a programme and commenting on progress against project stage and shorter-term deadlines for design tasks. Other than referring to the agenda and minutes from the previous meeting, the use of materials at these meetings was rare and limited to occasional note taking and minuting the meeting in progress. Seldom were design drawings brought to a design coordination meeting. This placed high emphasis on each person's account of what had happened on the project and remembering why this was relevant to the project at that point in time. This way of working encouraged a more collective sense of knowing 'where we are' as a team in the progression of the project's design.

A routine pattern at these meetings was for each discipline to present an update on their progress, starting with the project architect's account. At each meeting, there was interplay between accounting for activities that had happened during the week and task-coordination actions, when the design team planned future actions, for example, discussing which information was outstanding and allocating responsibilities for providing this. In this respect, design coordination meetings acted as project milestones, as minutes from a meeting set deadline dates for the completion of actions (for example, setting the next meeting as the deadline for information). However, to view these meetings solely as task coordination events, where plans are made for activities that will happen after a meeting (Ikeya, Awamura, & Sakai, 2010), under-represents what was going on. While task coordination and the planning of future activities did take place in this setting, a characteristic of these meetings was that the design team discussed and progressed the scheme's design *at* the meeting. Discussion of missing information often led to the negotiation of possible design solutions. It is this projection into what will or might happen that was remarkable, as possible solutions that were yet to be formalised in the design drawings or building model were debated. These provisional and tentative workaround actions were significant in sensitising and raising the teams' collective awareness of aspects of the design that need immanent attention and, as such, prioritised design work. Design decisions and problems that could be resolved then and there amongst the people present, in general were.

The major shifts in the topic of conversation were with reference to the agenda, as steered by the Chair. Within an agenda topic, the designers were self-organising, selecting next speakers for their input on specific design points. Some advantages of staging meetings where people meet and talk in person in a co-located setting became apparent. In this setting, in face-to-face interaction, a wide range of human proximal communicative resources were available: the intonation in speech as well as the content of what is said, gestures, bodily posture and orientation, gaze and peripersonal perception. It is this ability to sense, and 'to feel' when someone looks in your direction in particular that is not supported in other media. This communicative resource was noteworthy, especially in the selection of a next speaker, to make it known who was accountable to respond to a point being made. Many small actions featured in the organisation of who spoke next in conversation and, concomitantly, whose views input to the discussion of the design. The length of time spent in the discussion of the design content at these meetings varied, and

often the topics discussed warranted further attention and cross-disciplinary input outside a coordination meeting.

Improvised design meetings

The meetings characterised as improvised design meetings were most clearly illustrated by the events that continued after a coordination meeting, although they did happen at other times too. The term improvised acknowledges that these events were unplanned, creatively making use of the people available after a meeting, a practice observed in other situations (Tribelsky & Sacks, 2011). Improvised design meetings were events staged to discuss a particular design topic, although keeping the discussion to one aspect of the design, which was inevitably interwoven with others, was a task at these meetings. The choice in the location of these events was remarkable. In keeping with the room booking procedures for the organisation, which were scheduled to a time slot, the design team vacated the room where the design coordination meeting was held and found an unoccupied room. In this there was advantageous use of different kinds of workspaces within the office. This reflects their choice in where to work and personal volition, in not being held accountable for time away from their desk. It illustrates that design was taking place in multiple locations; design work is not only situated in the studio. In this choice of location, these events were seemingly put on a different footing from conversations that took place in the design studio.

In the change of location several things happened. This was a juncture for those present whose input was not needed on this topic to depart. Often there was a swift refreshment break before starting a meeting. This was an opportunity for other people in the office to join the discussion. Improvisation at these events was evident in self-selected involvement, advantageously deciding on a place to meet and finding people with the most relevant expertise to join in. With this, there was a choice in who will input on this subject at this time. This way of working was contingent on a local awareness of other's competencies, their current project commitments (major deadlines) their disposition to being interrupted and where they are at that point in time.

At these meetings, the project architect took a lead, steering the design focus and direction of the topic, although the meeting was not chaired. An architect from another project joined the meeting above (Figure 2) so his expertise and experience on a similar project could be brought into conversation. The design of the energy centre was the topic at this meeting. The team's creative exploration on this topic was enhanced through recounting vicarious, direct and indirect experiences (Gino, Argote, Miron-Spektor, & Todorova, 2009). These events were not minuted and as such no codified conclusions and next actions were recorded. Indeed, discussion of the contingencies in the design of the scheme rather than explicit problem solving and decision-making actions were characteristic of these conversations. These self-organised practices reflect a way that design was approached as collective activity, on occasion in an ecological huddle that evidently disrupts silo-thinking. This was an improvised event where knowledge-sharing and some form of learning between disciplines and across projects took place.

Design workshops

Design workshops were organised at intermittent intervals dependent on the project's progress, specifically for the whole design team to report on their progress and the development of the scheme.

The workshops took place in the design studio, which added to the sense that a project milestone-event was taking place. A design workshop was an opportunity to showcase the scheme and to profile its progress in the office. The event engendered a sense of occasion in the design studio



Figure 2. An improvised design meeting.

and raised awareness of the project and its achievements. However, this practice was not universally well received. For example, actions, such as, starting the dishwasher when a design workshop was in flow, were noted as a way of audibly disrupting and making it known that staging these events in the design studio was not well welcomed by all. The Director of Architecture was aware of this. Staging workshops in the studio was a deliberate intervention, a recent change in practice that was being profiled on this project. Design workshops are routine on projects and in this organisation. The change was in the location of the design workshops. There are received associations when working in open plan office configurations with disruption and loss of concentration (Banbury & Berry, 2005), yet breaking the notion that work in an office is a desk-bound activity (sitting at a computer workstation) and that being quiet is part of working in an open plan space, were knowingly being challenged and breached in this decision. Workspace, locations of work and associations in the kinds of activities that take place there are interwoven in this design ecology. The intervention was deliberate, to encourage design creativity and its visibility in a large organisation in an open plan setting (a characteristic also noted by Meusburger et al., 2009). Engendering across-project as well as multidisciplinary design creativity is something that is worked at in large organisations, in this case through deliberate intervention, a happening in the design studio (Figure 3).

In several respects, the design workshops share similarities with design crits in architectural education (Murphy, Ivarsson, & Lymer, 2012), as materials were displayed on pin-boards and were projected onto a wall, then one person presented their work to the audience and this design input was then discussed. The presentations were listened to and then critiqued by those present, as much to highlight areas for further attention rather than to resolve a specific problem at that moment in time (Figure 4).

Noticeably at these events, questions were asked that crossed design disciplines, expertise and seniority. At the concept design stage, when several scheme options were being considered, a less experienced architectural graduate presented their design, which was reviewed in a similar way to other schemes. The Director of Architecture joined several workshops and was able to dip into conversation when passing through the studio on other occasions, and in this way input into the discussion and assessment of the designs at his discretion. People working on other projects



Figure 3. A design workshop, staged against the backdrop of studio life.

joined this scheme's workshops, and others joined in the discussion when passing through the presentation area. This fluidity in engagement in the workshops was possible because these events took place in an open plan space and not in a separate room away from the studio.

Design workshops were an event that was seen to enable inter-project information sharing and learning from others' experiences to inform the development of the scheme. For example, discussing on-site difficulties with the configuration of a courtyard led to the discussion of how a similar situation was resolved on another project. These accounts of what has happened previously illustrate how local project histories were interwoven in workshop conversations; on occasion recounted as near-disaster stories that were then re-formulated as a lesson learnt.

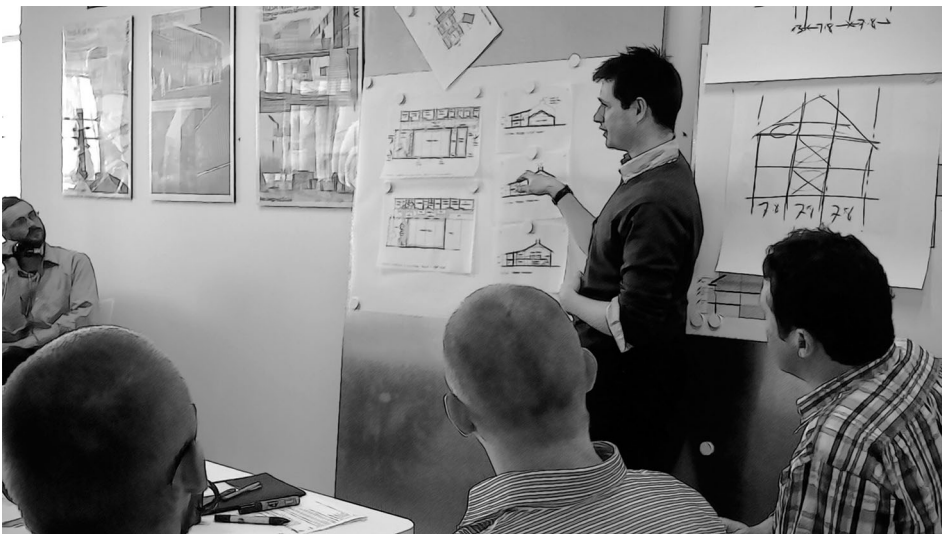


Figure 4. Presentation at a design workshop.

Finding ways to actively engage the valuable stock of knowledge and expertise that people have is an organisational concern that, arguably, is more pronounced in large organisations. The design workshops provided a forum for this exchange to happen. They illustrate an active way that organisational knowledge became manifest. This practice is considered to be more vital and accessible than the preparation of retrospective project case studies that are stored in repositories, with summaries posted to the organisation's intranet, although this happened too.

Seemingly this event 'type' served many design coordination functions, yet it was only possible because the design team was multidisciplinary and based at the same location. The event provided a deadline for the completion of design work, as production drawings, sketches and models were needed for the designers to be able to talk to. Workshops were events in the workplace that engendered a sense of occasion and collective project-team achievement, and importantly encouraged inter-project organisational learning and the cross-fertilisation of design ideas. While creativity and learning is considered to be spatially situated (Meusburger et al., 2009), seldom can the location of situated learning and the transfer of knowledge between projects be located, spatially. The design workshop was an event convened at a time with a location for this.

Life in the design studio

It was in the design studio that multidisciplinary as a way of working was most clearly evident. The design studio was a setting where knowledge workers generated design content at their workstations and the conversations that took place there were influential in content creation. To encourage greater collaborative working, the design studio layout was configured around projects. This was a management decision yet the design of the layout of studio was a task for the future occupants engaged in. The designers who now inhabit this workspace designed the building and the office layouts with an awareness of the spatial distribution of their own creative practices. The team working on this project sat at workstations in close proximity, to encourage greater interaction and collaborative working. Relationships between creativity, communication and proximity are known (Emmitt, 2007, pp. 248–249; Meusburger et al., 2009). Working in a studio milieu that was conducive to creative interaction was contingent on being able to see where colleagues are and, to some degree, knowing what they are doing at that point in time (Heath, Sanchez Svensson, Hindmarsh, Paul, & vom Lehn, 2002).

In this setting, knowing when to pay attention comes into play. Activities in the environs can be seen and some are overheard, which can help in maintaining an awareness of what is happening on the project, without being directly involved. At other times, designers were in the flow of focused knowledge work and being distracted by background activities was a consideration. While patterns of activity in the day, taking breaks, walking through the office and events in the studio engendered, in a general sense, an awareness of what was happening in the studio, this also happened in more subtle ways. Working in an open plan studio, the designers were aware of other people at work in this setting. This proximal awareness came into play when approaching a colleague to talk about the project. There was subtle judgement when to interrupt someone at work. At other times, pressing project events superseded a more considerate approach.

Characterising ad hoc conversations in the design studio as a form of design event is unusual, but these interactions underpinned collaborative design work in this setting. Conversations that can happen now, because the design team was co-located, mark and exemplify this multidisciplinary approach to design. Often these were conversations to address a particular design issue, now, when contact by email or telephone would have introduced a delay. The term ad hoc acknowledges that these interactions were improvised, yet these were deliberate, in response to something that was happening at that moment in time. Ad hoc associates these activities in the studio with routine workarounds that are part of how people get things done with the resources currently

available to them (Koopman & Hoffman, 2003). It was the expertise of proximate work colleagues that was the resource being drawn on. These included interactions at computer terminals, jointly viewing images on a screen (Ivarsson, 2010), looking at drawings, marking-up and sketching ideas to develop and resolve design clash issues (Henderson, 1999; Wagner, 2004). Talking to colleagues, for example, to discuss what was likely to happen in the afternoon, while they were away from the office, was a way to contingently organise the design work in response to current circumstances. Routine practices such as these were indicative of local coordination activities on projects, self-organising design activities in a more detailed and immediate way than at meetings. Significantly, working in a project-focused ecological orbit, these conversations were with colleagues with various design expertise.

The focus so far has been on interaction in person, without acknowledging the information systems that underpin the activities and interactions of the design team. Information systems enable geographically distributed design work, however, seldom acknowledged are the varying degrees that design teams are geographically distributed. Collaborative design work, even for these designers working in near proximal situations, was technologically mediated over distance. The workplace was one means to encourage interaction across disciplines and between projects, the information architecture platform, software applications and a desktop dashboard with a suite of collaboration tools were others. This team accessed a suite of design tools and collaboration media from the computer terminals at their workspace, through a network. These were the tools and technologies that supported hardwired collaboration.

Design activities were seen to be distributed throughout the office, the locus of digital design content creation, however, was at a computer. The designers, irrespective of their discipline, spent a substantial period of time at work using a computer and design tools from the Autodesk suite. This activity was augmented with email correspondence and using the organisation's intranet-based file storage repository to back-up and share design content. There were organisation protocols in the use of the repository and knowing when to post information to this system were project concerns (Kimmerle, Cress, & Hesse, 2007) and file-sharing was discussed on occasion. In the transition from the production of drawings in 3D CAD to a Revit model not everyone in the team was using this system. The coordination of the building's design was to some degree assisted using a shared design tool with a clash detection function. The imprecision of the building object, as it was being designed, however remained characteristic of design work in this environment too. Drawing attention to the 'known unknowns', the project risks as these can be defined in information terms (Winch, 2010, p. 350) were persistent concerns, irrespective of the design environment. Primarily the concerns were the availability of information, its precision and certainty (Luck, 2013).

Discussion: a multidisciplinary design ecology

The organisation of design work in this multidisciplinary practice was seen to take place through a series of patterned events and improvised interactions in the workplace. Staging coordination meetings in a room away from the studio, members of the project team were party to discussions of the design's progress and in the planning of next action. Development of the scheme's design was also improvised in ecological huddles and conversations in the studio. Workshops in the design studio raised the profile of the project and heightened awareness of this scheme, generally, throughout the workplace. Importantly, in providing an intervention into desk-bound activities in an office setting, these events were opportunities for cross-project engagement in design work and learning from others. However, collectively, these were nested contexts in the organisation of design work, where activities in one setting lead to other events and interactions. This organisation of patterned events with a loose fit, was a way of working that illustrates the benefits of

a distributed awareness of design work throughout the workplace to cross both project and design disciplinary interfaces. The ‘nested contexts’ and ‘patterned with a loose fit’ characterisations aptly reflect the flow of design work and its ecological embeddedness in this organisation. With this way of working characterising a meeting or interaction event by type with a kind of design organisation would under-represent how design activities permeate this ecology. When design is studied in the wild of the workplace, the actions and activities connected with designing and the ways that they are organised and coordinated were seen to be not so easy to compartmentalise. Design work was distributed across workplace settings. Evidently there were advantages with this co-located working arrangement, in the multiple and sometimes unexpected ways that cross-disciplinary design collaborations happened in the workplace. Multidisciplinarity as a way of working was only possible because this team was working in a co-located setting, in a shared workplace where the designers were in close proximity. In this design ecology, the production of design content was evidently an integration of the hardware, the workplace settings and information systems, with the software, the patterns of interactions and practices of the people at work there. Multidisciplinarity was seen to be a way of designing collaboratively, to offer a design service that straddles disciplines and cuts through some design interfaces.

Conclusion

Studying the ecology of a multidisciplinary design team, this research has outlined how design work was organised through patterned events, interactions and practices in the workplace. The locations and settings in which design interactions take place were seen to feature in the actual organisation of the design work. In several workplace settings it was seen that the organisation and coordination of the design work took place through the self-organised practices and when the conversations of designers were overheard by the other people present. In short, there was no one event type, or person that solely coordinated the design work for the project. The coordination of design was a communicative act that was nested in conversations as well as using more specific and directed collaborative design tools and information systems within the workplace. Working in a co-located arrangement, there were advantages in the organisation of planned, as well as improvised, ad hoc events, when members of the design team met in person to talk and debate the design work in progress. An advantage of location-based working was the ability to flexibly and swiftly respond to things that happened on a project. From this insight, *multidisciplinarity* is proposed as a particular way of offering design services that is responsive to the routine and the unanticipated events of both project and studio life. Delivering design services in this manner is, however, contingent on the co-location of multidisciplinary design teams.

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Notes

1. Architectural management is a term also used to describe the organisation of the design tasks in the production of project information, as well as the management of design firms

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