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Tracing client interests in the course of a project: why are some client interests incorporated whereas others are not?

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Declaration

I confirm that this is my own work and the use of all material from other sources has been properly and fully acknowledged.

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Abstract

There is a widespread assumption that client expectations should be accommodated during a building project. However, studies which highlight the complex nature of construction clients point out that this assumption is not easy to address. There may be conflicting interests within a client organization and these may change over time in the course of a project. This research asks why some client interests are incorporated whereas others are not into the development of a building project. Actor-Network Theory (ANT) is used to study a single building project on a University campus. The building project is analysed as a number of discussions or negotiations, in which actors persuade each other to choose one solution over another. The actors include: client organization members, architects, engineers and architectural floor plans. The issues which examined include: building location, space allocation and mechanical space size. An ANT analysis of a range of actors and issues provides a way to study client engagement without privileging client perspectives.

The analysis documents changes in the types of decision-making processes at play as the range of options for any particular issues are constrained by prior decisions. More specifically, the thesis reveals the shifting power relations between clients, project team members and project documents. At the start of the project, the clients specified the range of options and chose their preferred solutions. Later on, the interdependence of issues led to a moderation of client interests; project team members persuaded clients to compromise on some of their preferences. Similarly, project documents fixed certain decisions, which shaped or limited available options for subsequent issues. In this way, clients' ability to select their preferred options was increasingly constrained as the project developed. Clients, however, retained the power to control the timing of other participants' involvement, and in this way, to impose their interests over others. The thesis develops the concept of "interest" in ANT analysis, and documents the way clients secure their interests in the course of the project. It concludes with practical recommendations to clients about how to be aware of their conflicting interests.

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1 Introduction

Construction research on customer solutions and added value often emphasizes the service dimension of construction projects (Leiringer and Brochner 2010). Over the last few years, policymakers, practitioners and academics have encouraged the construction sector to shift its attention away from simple product delivery towards satisfying more general client needs. In such a client-focused climate[1], the accommodation of client expectations throughout projects emerges as a significant topic of study, both for clients to maximize product values and for construction professionals to flourish.

This research explores how various changing client expectations are accommodated over the course of a construction project. I became intrigued with this topic during a previous research project, in which I studied the refurbishment of apartment houses in Japan. A number of owners initiated refurbishment projects starting from organizing themselves, planning the budget and schedule, and selecting subcontractors directly or appointing consultants in some cases. These owners knew little about construction practices, and thus relied on project team members' skills and experience. Thus, the project team members carried out these projects based on their understanding of the owners' expectations, and the projects developed according to the evolution of both the clients and project team members' ideas. I was interested in studying how seemingly inexperienced and unskilled clients engage in construction projects. This research aims to examine how client expectations shape projects, and thus, influence what completed buildings are like.

A number of issues complicate the study of accommodating client expectations. The first involves the various and changing nature of these expectations. Studies concerning construction clients (e.g.

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[1] Between 1993 and 2003, various government agencies and industries have attempted to ameliorate the often adversarial nature of client-contractor relationships. This client-focused climate was highlighted by the publication of the Latham report (1994), which involved construction clients, as well as the Egan report (1998), which recommended adopting the management methods of other customer-oriented industries (Adamson and Pollington 2006:7).

Cherns and Bryant, 1986) note the inherent complexity of *client organizations*, which often encompass various individuals and organizations with diverse expectations (referred to here as clients). For example, property developers are typically concerned with their portfolios and payment for taxes; prospective tenants and owners have expectations about the use of space; and property company personnel have career ambitions[2]. Moreover, these client expectations often change over time as the client organization's business activities evolve and a construction project develops.

Another difficulty involves the changing nature of project team members' goals and ambitions over the course of a project, which can influence client expectations. The literature on stakeholder management (e.g. Newcombe 2003) discusses the range of stakeholder expectations. Project team members – including architects, engineers and contractors – participate in a project at various points: architects seek to gain skills and knowledge; contractors are concerned with the continuity of their work; and engineers may want to introduce new technologies. Moreover, as a project develops, more information becomes available regarding site conditions, project budgets and legal restrictions. In this way, project team members may change their goals and ambitions over the course of a project, and these changes may conflict with client expectations.

The aim of the research is to study how client expectations shape the development of a building project. The research objectives are as follows:

1. To explore multiple and shifting actor expectations in the course of a project.

A starting point of this research is to trace multiple and shifting expectations of both clients and project team members. As client needs and requirements are seen to be changeable, they cannot be predetermined beforehand. Instead, the thesis examines project participants' interactions and analyses their expectations at successive moments in the course of the building project.

2. To examine how project participants' expectations are accommodated through their interactions

[2] Further examples of various client member concerns are discussed in Boyd and Chinyio (2006), who investigated diverse firms, such as those involved in supermarket, retail and airport construction.

This thesis traces how a building design develops through successive interactions between clients and project team members. The study of project participants' interactions in the course of a project allows for an analysis of how their multiple and shifting expectations are discussed and negotiated, and eventually incorporated into design and construction decisions.

3. To analyse how clients impose their expectations on the building project.

The analysis of the way some of their expectations are accommodated whereas others are not during interactions serves as a basis to reflect upon how client expectations are accommodated among the range of actors involved in the project.

Current insights into the treatment of different and changing participants' expectations in the literature in construction management are examined in Chapter 2. Some studies in the area of procurement and briefing take into account the complexity of client expectations; the aim of the research is to develop a linear model of how client expectations are clarified, specified and delivered. However, they do not analyse how client expectations unexpectedly emerge or change in a specific project context. A second set of articles compares client expectations at pre-design and design stages. This research explores participant interactions across the building process, and considers the involvement of not only clients, but also project team members and even material objects, which potentially influence client expectations. Building on the studies of client and project team members' engagement in the course of a project, this thesis particularly focuses on negotiations and persuasions between project participants who hold different expectations. This allows for an analysis of how client expectations are accommodated in the course of a project.

Chapter 3 explores the use of Actor-Network Theory (ANT) to analyse the range of actors' interactions and the way their expectations are incorporated into the development of a building project. This succession of negotiation and persuasion processes can be analysed as occasions in which actors attempt to persuade each other to adopt particular solutions. For this study, relevant actors include clients, project team members and material objects, and potential issues subject to discussions include design scheme development, use of specific technologies, calculation of structural stability, site preparation and supplier selection. Client engagement was studied across a broad range of actors and issues without privileging client perspectives, which provided a means to trace multiple and shifting client interests over the course of a project.

Chapter 4 sets out the design of an empirical study; this thesis investigates a single university building project. The building was designed to house special facilities, including theatres and film and TV production studios, and the project's clients were actively engaged in its process. Data was collected from interviews and project documents and analysed to identify key issues with respect to the project and its relevant actors. To begin, several clients were interviewed including user groups, University administration and Estates Department members. These initial interviews were used to identify relevant project team members, who were also interviewed. In addition, these interviewees identified key issues which were subject to discussions. These issues were analysed to explore the range of actor interactions and how their interests were incorporated into project decisions.

Chapters 5-7 analyse the decision-making processes undertaken by both the clients and the project team members with respect to three issues – building location, space allocation and mechanical size – which spanned the course of a project. ANT analysis of each issue explored the following question: why are some actors' interests incorporated into project decisions whereas others are not? The first issue, locating the building involved a number of University members, who iteratively chose different options for the building site. The second issue, allocating building space involved architects and a user group who discussed interdependencies between a proposal about one space and that of another space. Finally, determining the mechanical room design involved the architects, services engineers, structural engineers and an acoustician, whose decision about one issue shaped decision-making processes about subsequent issues.

Chapter 8 summarises the results of the analysis. A main finding concerns changes in the decision making dynamic as the range of options is constrained over the course of a project. More specifically, the analysis reveals the shifting power relations between clients, project team members and project documents; as the project developed, clients' relative power to choose from options became more constrained, while the power of project team members and documents increased. This discussion then serves as a basis to reflect on how clients impose their interests among a range of actors.

Chapter 9 provides an overview of the thesis and clarifies theoretical and methodological contribution, limitation of the research and future research direction. This research suggests that the process of completing a building project is the product of a range of actor negotiations. Such a view allows for an analysis of the way some actor interests are incorporated and others excluded during participants' engagement in decision-making processes. As a result, the analysis reveals the impact of client engagement, in other words, how clients impose their interests over others in the course of the project.

2 Clients in construction projects

A widespread assumption exists that client expectations should be accommodated throughout the construction project process. However, some research highlighting the complex nature of construction client expectations points out that this assumption is not easy to address. For example, conflicting expectations may exist within a client organization, and these expectations may change over the course of a project. Some studies in the area of briefing and procurement discuss the range of constantly shifting client needs and requirements, within which the studies of participant interactions particularly trace the ongoing change in client expectations. While such briefing research focuses on client-consultant interactions, studies of client engagement in the course of a project reveal project team members' potential impact on client expectations. Stakeholder engagement studies particularly analyse the way project participants who hold different expectations adapt project decisions. Building on these studies, this thesis examines a series of negotiations over project decisions between project participants who have different and changing expectations.

2.1 Various and changing client goals and requirements

Several construction management researchers highlight the "complex" nature of construction clients (Cherns and Bryant 1984; Green 1996). They point out that there may be cooperation and conflict between individuals inside a client organization, and their project goals may change depending on project situations. Some procurement and briefing research takes into account different and changing client goals.

A number of authors in the area of procurement cover a range of standard client goals and requirements including cost, time quality as well as flexibility and space usability (e.g. Bresnen and Haslam 1991; Franks 1998:4; Chinyio *et al.* 1998). For example, Bresnen and Haslam (1991) and Franks (1998:4) categorized those goals, including time, cost and quality, as indicators to measure the efficacy of each procurement strategy option. On the other hand, Chinyio *et al.* (1998) listed more diverse client needs in order to assist specific clients' choice of procurement strategies. However, they typically assume that client needs remain fixed and stable[3] throughout the course of a project. As the above list indicates, they focus on client needs, which are in fact, construction deliverables that contractors aim to offer at the end of a project.

In contrast, briefing research assumes that client requirements are clarified and specified during a briefing process. Researchers in this area called for an improvement of briefing based on an assumption that ineffective briefing processes may cause problems, including delays in project completion, stakeholder conflict and repeating work (Mackinder et al. 1982; O'Reilly 1987). Othman, Hassan and Pasquire (2005) and Yu et al. (2007) list a number of management methods and sought the best methods to unify and fix different client requirements. Their research is based on surveys with experienced project participants. However, the authors tend to focus on managers' tasks and treat clients as external actors during this briefing process.

Other research proposes a structured guideline of client engagement process, often with an aim to manage different and changing client needs (Kamara, Anumba and Evbuomwan 2000; Connaughton and Green 1996; Walraven and De Vries 2009). Specifically, researchers propose a linear process by which client requirements are clarified and specified through continuous comparison and prioritization between different client requirements. Both Kamara, Anumba and Evbuomwan (2000) and Walraven and De Vries (2009) use a standard which is called QFD house quality matrix to cover diverse client requirements comprehensively. However, the proposed processing models are still different from each other depending on the kinds of projects (such as a housing project and commercial project). Moreover, Connaughton and Green (1996) were aware of the specificity of each client's value, which the authors suggested would be explored during value management workshop during projects. The above authors proposed the way client requirements are specified in

[3] Within procurement research, Blismas *et al.* (2004) take into account the flexibility of client needs (thus, changing client demands) in their study of project delivery strategies. However, the authors still assumed that the *types* of changing demands are fixed throughout a project.

their structured model while attempting to cover each client’s specific requirements comprehensively. However, their proposed linear process does not explore in detail client needs and goals which unexpectedly emerge or change in a particular project context.

The approaches identified above describe processes through which clients can be helped to prioritize, clarify, specify and have their requirements delivered throughout a project. However, structured guidance is not always sufficient for understanding how changing client requirements are clarified during a project. In contrast, the studies of client interactions reveal the ongoing changes in client expectations.

2.2 Client engagement in interactions

Client engagement is often studied in interactions between client organization members and between clients and consultants during briefing and design stages. These studies allow for the analysis of client expectations which emerge and change in a specific project context. Other studies further examine client engagement in the course of a project taking into account project team members’ involvement. They focus on particular types of processes such as information processes and rational procedures and individual behaviours. Each of the studies highlights some aspects of dynamic client engagement depending on the types of processes they studied.

2.2.1 Client-consultant interactions

The area of briefing research recently shows a transition from optimising a proposed structured process towards understanding of social interactions in specific contexts (e.g. Barrette 1999). Fernie, Green and Weller (2003), who discussed the application of requirement management (RM) in aerospace to construction practice, argue that structured procedures need to be adapted to suit specific contexts in practice. Based on this argument, the authors claimed that construction management researchers need to tackle with “the proactive management in response to changing requirements” rather than avoiding changes. In other words, study methods are required which analyse changes in client requirements.

Researchers who examine participant interactions in the briefing stage often analyse the ongoing emergence and changes of client expectations that occur during this process. Significantly, these authors examine how client identities and relationships with consultants, together with client requirements, emerge and develop through interactions. Green and Simister (1999) explored how various clients' perspectives are clarified through their interactions prior to the briefing process. The authors particularly focused on different client organization members' perspectives on the definition of a project as expressed in a seminar workshop. For example, one participant perceived the provision of research facilities as the project goal, whereas another participant perceived this as the provision of educational facilities.

With a particular attention to the role of consultants, Alvesson *et al.* (2009) studied a process by which interactions influence the prioritization between client expectations. The authors investigated how consultants assist in clarifying client expectations and perceptions[4]. Results showed that as the consultants had direct contact with the project managers, they prioritized the project managers' motivation over the client managers' ambitions. Significantly, the consultants' own interests influenced their prioritization of different client expectations. Similarly, Luck (2007) analysed how architects with different levels of skills and experience can influence the emergence of client expectations. Findings showed the affect the architect's more advanced conversational skills and experience had on the emergence of user expectations. For example, regarding window design, the experienced architect appealed to users by raising concerns about the risk of being observed by passers by. Only after this conversation with the architects did the users' interests in privacy emerge.

The above studies highlight several ways that client expectations emerge, change and are clarified through interaction. The relationships that influence this process, which are of course specific to project contexts, include those between client organization members themselves and also the perspectives, experience and skills of the consultants involved. Briefing studies of participant

[4] Although this study concerned a corporate strategy consultancy and not a construction project, the client-consultant interaction studied in this research can be regarded as similar to that of a construction project.

interaction allow for an analysis of changing client expectations in a specific project context. As a final note, although researchers who study the briefing stage argue that it is a process that continues throughout the life of a project (Barrett and Stanley 1999; Pemsel, Widen and Hansson 2009), they tend to associate briefing with client-consultant interactions prior to a design stage. By contrast, the next section reviews the literature on participant interactions over the course of a project.

2.2.2 Client participation in the course of a project

Research on client engagement typically focuses on various project stages. In addition to looking at the procurement and brief stages, study themes also include the initiation of projects (Kometa and Olomolaiye 1997) and real estate management and maintenance (Kadefors and Bröchner 2004; Straub 2010). In addition, a number of authors have examined client engagement throughout the life of a project[5]. The analysis below discusses some of the studies that have examined diverse and changing client expectations during participants' interactions in building projects. The studies vary in terms of the types of interactions they studied: decision-making processes, information processes and informal interactions. It is important to note that participant interaction in projects includes both those within client organizations and between clients and project teams.

The studies of decision-making processes reveal the impact of client engagement on project decisions. Connaughton (1993) explored how clients change their organizational goals mid-project to better reflect their business activities. Using case studies of pharmaceutical companies' factory projects, the author analysed the companies' resource allocation processes with respect to investment decisions. He then documented the impact of a number of clients' participation on key decisions about project issues, including factory location, schedule, procurement methods and foundation design. Notably, this study assessed client goals through the lens of organizational rational procedures, thus does not reveal the impact of individual expectations inside a client

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[5] In this section, *client engagement* does not necessarily mean engagement from project inception to completion. Rather, this term encompasses a broader time scale beyond each of the traditionally pre-defined stages, including briefing, design and construction.

organization. In contrast, studies of informal[6] interactions typically analyse clients' individual behaviours. De Blois *et al.* (2011) investigated how informal communication and coordination can influence project participants' relationships and organizations irrespective of organizational structure. Using a university project as a case study, the author documented how the views of various client organization members emerged as they interacted with an architectural firm. While the above authors who study client engagement in decision-making processes account for project team members' involvement especially at the later stage of a project, they did not particularly highlight their impact on their perspectives which are likely to be different from clients.

In contrast to the above authors' main focus on client perspectives, Haroglu, Glass and Thorpe (2009) study different criteria for structural frame selection between project managers, consultants and construction clients. Based on survey data asking participants to rate the importance of different criteria (such as building use/function, cost and preference), the authors discovered that the extent to which different parties considered these criteria changed from the concept stage to the detailed design stage. Significantly, the authors take into account project participant's criteria which changed over time. However, they do not further analyse the impact of the difference between clients and project team members' perspectives on decision-making processes.

Apart from the studies of decision-making processes, some researchers paid attention to information processes as a way in which client expectations are clarified and delivered to project team members. This research revealed how clients and project team members' different perspectives influence emergence or changes of client requirements. Winch, Usmani and Edkins (1998) investigated how project participants manage the gaps between client expectations for as-planned versus as-built facilities. For this study, quality management methods, including documentation and assessment processes, were analysed through a case study of a major building

[6] The term *formal action* typically refers to the actions of participants made according to an organizational structure or procedure, whereas *informal action* refers to participants' behaviour based on their interpretations and decisions.

project. One of the authors' findings was the potential affect of project team members' individual perceptions have on the accommodation of client requirements; different project team members have their respective perceptions of what was meant by complete design, which influence design processes. While Winch et al. (1998) focused on a client as a single organization, Thomson (2011) investigated how diverse client members set their respective requirements informally to project teams without the assistance of a liaison. The author documented the emergence of various client team members' respective requirements at different times in the course of a refurbishment project.

Studies of decision-making processes reveal the impact of diverse project participants' perspectives on dynamic project decisions, while the studies of information processes analyse how client requirements potentially emerge or change as they are delivered to project team members. Also, studies of informal processes reveal clients' individual requirements instead of organizational goals. However, the distinction between the foci of these studies does not allow for an analysis of successive processes in which both organizational and individual client requirements are delivered to project team members and influence project decisions.

Hedgren and Stehn (2013) attempted to overcome this limitation by assessing the adaptation of three types of decision-makings (rational, judgements and managing multiple meanings) in different sub-processes of a decision-making process of industrialized building projects. The sub-processes include information processes as well as decision-making processes which were carried out through either organizational procedures or individual behaviours. Although such studies contribute to the understanding of dynamic decision-making processes, in which client organizational procedures or individual behaviours iteratively influence project decisions, the research does not examine client goals and requirements in a specific project context during client engagement.

This section (2.2) reviewed the studies of client interactions in briefing and those in the course of a project. While briefing research reveals the way client expectations emerge and change under the influence of specific project context, its examination is limited to client-consultant interactions at briefing stage. Studies of client engagement in the course of a project expand the examination of client interactions to those between clients and project team members at the later stage of a project. However, these studies tend to focus on particular aspects of dynamic client engagement: organizational procedures to change goals or to get requirements delivered, individual behaviours to demonstrate different requirements or emerging requirements at different times. Significantly, whichever aspect is studied, the way specific client requirements emerge, change, and are delivered to project team members and influence project decisions is studied through the examination of interactions. Therefore, this thesis examines project participants' interactions in the course of a project. A number of studies particularly focus on interactions of project participants who have different perspectives, irrespective of types of processes.

2.3 Studies of the range of project participants

Studies which analyse stakeholder engagement examine a broad range of project participants in construction projects. The studies highlight conflicts which happen due to participants' different perspectives on project goals. In addition, the impact of such conflict on changing project decisions is analysed.

2.3.1 Stakeholder engagement

Stakeholder engagement studies focus on various participants[7]who are involved in providing resources and skills in construction projects. These participants' different concerns are often analysed as those that influence project outcomes (Atkin and Skitmore 2008). The studies below highlight some of the research on diverse and changing stakeholder goals and expectations, which potentially influence client goals and requirements.

Using a stakeholder mapping approach, Newcombe (2003) analysed the varying expectations of various stakeholders, including clients and project team members. In this study, the term

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[7] A *stakeholder* is defined as "any group or individual who can affect or is affected by the achievement of a corporate purpose" (Freeman 1984).

stakeholder encompassed the public, developer, local authority, designers and the insurance company. The author developed a method of mapping both stakeholder interests and influence in a matrix to allow project managers to predict and manage potential conflicts based on the probability of different participants enforcing their expectations. Building on Newcombe (2003), Olander (2007) developed stakeholder analysis further to expand the definitions of stakeholders as those who have either power, legitimacy or urgency to influence project organizations and activities. The authors argue that those who do not benefit from project outcomes but have influence on projects (e.g. the media) should be taken into account as stakeholders. The identification of diverse stakeholders by Newcombe (2003) and Olander (2007) is useful as it suggests the need to continuously consider the range of constituents of participants who have impact on a project at different times. Their analysis potentially takes into account organizations, groups and individuals holding different expectations at any given moment when they become likely to influence project decisions. However, the authors did not study how stakeholders interact with each other.

In contrast to the above authors' aim to assist project managers in avoiding conflict, other researchers have recognised that some conflict in the design process is inevitable, as stakeholders often perceive project goals differently from each other. For example, Gardiner and Simmons (1995) examined nine construction projects for design process conflicts between stakeholder interests and priorities, and advocated the development of mechanisms to minimise unanticipated changes due to conflict within different organizations as a practical implication. Although the authors examined conflicts as inevitable, they still regard them as potentially negative factors for the efficacy of projects.

While the authors cited above aim to develop strategies for project managers to manage stakeholders. Mathur, Price and Austin (2008) argue that stakeholder management can also be examined from ethical or social learning approaches. Viewed from a social learning approach, stakeholder engagement is seen as a process by which stakeholders mutually learn from each other.

In a similar vein, Leung, Ng and Cheung (2002) argued that a certain level of conflict can encourage project participants to specify their agreed goals and reach effective solutions. However, the authors used survey data to measure the impact of conflict on stakeholder satisfaction, and thus did not directly assess how stakeholder conflict influences project goals.

Liu and Walker (1998) also suggested that participant conflict allows for ongoing adaptation of project goals to reflect stakeholder perceptions and changing contexts. According to the authors, conflict occurs when participants make decisions that affect overall project goals or behave differently based on their diverse perceptions of those goals. As a result, such conflicts can lead participants to shift their goals to better suit the wishes of all involved. Also, the authors noted that project goals often change over time as new information becomes available. Based on these observations, the authors proposed following a sequential cycle – goal setting, evaluation and performance feedback – to help participants to iteratively reflect on their respective goals at any given moment of a project.

Chinyio and Akintoye (2008) further investigated stakeholder interactions in practice which influence project decisions. The authors particularly studied how management procedures are used during stakeholder interactions. Interviews were conducted with construction companies, as a result of which the study suggested that operational techniques to manage conflict and make decisions include communication, negotiation and consensus. As this study suggests, persuasions and negotiations are ways to manage different and changing stakeholder expectations which are eventually accommodated. Such processes are worth detailed examination.

Studies by Ivory (2004) and Bresnen (1991) specifically illustrate how clients and project team members negotiated and persuaded with each other, which impacted on project design and construction delivery decisions. In his study of a social housing project, Ivory (2004) showed how the architects persuaded tenants to select their proposed design, which was based on their firm's focus on implementing innovative design. In order to convince these tenants, the architects impressed them with attractive renderings and the promise of extra space created by a curved metal roof. Only thereafter, the author suggests, did the tenants' expectations for aesthetic design and the use of space emerge. Thus, this study suggests how the architects' persuasion can influence user expectations. Significantly, as a result of these interactions, both the architects' ambitions and the users' expectations were accommodated as the architects' design proposal was adopted.

Furthermore, an analysis of a laboratory project by Bresnen (1991) illustrates how project team members can negotiate their respective tasks at the detailed design stage. For this project, the designers, contractors and subcontractors all held different expectations of each other's respective tasks. When the client reduced the budget mid-project, the designers dramatically changed their design to accommodate this reduction. As a result, the designers expected the contractor in turn to compel his subcontractors to more quickly complete their work. However, the subcontractors expected the contractor to support their requests for more fixed and detailed design specifications. The management contractor stepped in to organized negotiations between the parties, and as a result, the subcontractors agreed to finish the work in exchange for extra payment. Thus, a change in the client's budget led to a re-evaluation of project team members' expectations of each other's responsibilities. Significantly, each participant's expectations were partially accommodated, as they learned to compromise with respect to their perception of each other's tasks.

These studies of participant interactions (including clients and project team members) during the project design phase suggest how different participants' expectations can change throughout this process as well as how these expectations can be accommodated through persuasion and compromise. The studies also suggest the importance of accounting for project stakeholder expectations with respect to how client expectations are accommodated. As project team members complete design and construction tasks based on client expectations and their own standards, the expectations of both groups were analysed to study how different and changing client expectations are accommodated in the course of a project.

In sum, stakeholder management studies which aim to strategically avoid conflict revealed the diversity and dynamics of project participant expectations, while those who are influential on project activities change over time (Newcombe 2003; Olander 2007). Also, the studies which regard project participants' conflict as social learning process proposed that project participants continuously adapt project goals by reflecting their respective expectations through negotiations and persuasions (Liu and Walker 1998; Chinyio and Akintoye 2008). In fact, the relevant literature which illustrates participants' persuasions and negotiations at the briefing, design and construction stages examine both how client expectations emerge, change, and are accommodated under the influence of project team members who have different goals from clients. This thesis traces negotiations and persuasions between project participants and the way their different and changing expectations are accommodated over the life cycle of a project.

2.3.2 The role of material objects in projects

Throughout the building process, project participants are not the only parties who can influence expectations. In fact, material objects often play a significant role in participant interactions. The role of material objects in participant interaction – such as models, sketches, drawings, contracts, construction materials and building components – has drawn significant attention in recent construction management literature. Generally speaking, with respect to this area, researchers study how objects can influence the flow of knowledge and learning during project participant interactions (Bresnen and Harty 2010), with the assumption that material objects influence these interactions. The role of material objects during such interactions analysed by each author is different from each other. For example, Bresnen (2010) treated material objects as enablers and/or barriers to communication and knowledge sharing in his study of partnering. In contrast, Berente et al. (2010) studied the dynamic role of information communication technology (ICT) as facilitating knowledge creation or pooling information in their study of the complex design processes of a Frank Gehry project. In another example, Sage, Dainty and Brooks (2010) studied how project management tools are used in projects, and revealed their role as prescriptive tools, interpretative tools or both concurrently.

Closely related to the topic of this thesis, a few researchers pay attention to the role of material objects in clarifying or carrying client requirements. Luck's (2010) study of the development of spatial configuration illustrates how drawings can facilitate the emergence of user expectations. In this study, architects presented users with drawings showing alternate configurations for a residential kitchen, living room and dining room, and then clarified user expectations of access to outdoor space through comparing those configurations. Significantly, the drawings developed as client requirements were clarified. This suggests that the architects' drawings both influenced and were influenced by the clarification of user expectations.

Similarly, Ryd (2004) demonstrated how a design brief developed over time as it was circulated between different project participants. The author studied a project for which a client employed brief-based procurement. First, the client presented a project brief as a business plan to a prospective tenant. The brief was written based on the client's expectations for setting open functional requirements to accommodate potential changes and delayed decisions until the last minute. Second, to facilitate the development of solutions through the design process, the project planner removed the fundamental criteria stipulated in this original brief. Finally, during the tendering process, the project contractor deemed the brief conflicted with his expectation for clear and fixed project requirements. In this way, the author revealed how the project brief developed over time and interacted with different project participants differently..

The above studies illustrate the role material objects can take in project participant interactions. Clearly, objects can develop through participants' interactions reflecting their expectations over the course of a project. It is notable that objects can themselves also represent the development of design briefs and the design process, which suggests that material objects can facilitate the ongoing incorporation of expectations into project decisions at any given moment of a project. To explore this phenomenon, this study analyses the involvement of material objects in participant interactions.

In this chapter, the literature examining project participant interactions, including those of both clients and project team members, was reviewed. Instead of focusing on particular project participants at a particular project stage (such as briefing studies that concentrate on client-consultant interactions), this thesis builds on a perspective that a range of project participants whose expectations often change over the course of their interaction are involved in projects. In contrast to studies that examine particular aspects of dynamic client engagement (such as organizational procedures or information processes), the thesis examines how multiple participants who have their respective expectations persuade or negotiate with each other at various times. Building on stakeholder engagement studies, this thesis particularly analyses the way project participants' different and changing expectations are accommodated and influence changes in project decisions. Besides, following the studies of the role of material objects, this thesis accounts for the involvement of material objects, as these objects often influence the expectations of project participants as well as represent the ongoing incorporation of participant expectations of project development process. To do so, this study employs Actor-Network Theory (ANT) to analyse the interactions of these actors. The following chapter introduces ANT, which affords a powerful means to study the incorporation of client expectations into the building process.

3 Actor-Network Theory

This study adopts Actor-Network Theory (ANT) to examine the incorporation of various (and often shifting) client expectations into the development of the building project process. For the purposes of this research, a building project was analysed as a range of discussions in which actors persuade each other to adopt one solution over another. In this context, the term *actor* includes both individuals and material objects, such as client organization members (i.e. clients), architects, engineers, contractors and architectural plans. The incorporation of actor interests into the development of a building is analysed in the way actors' preferred solutions are chosen as project decisions. ANT analysis of a broad range of actors and discussions facilitates the study of client engagement without privileging client perspectives. This approach, in turn, affords a means to trace the expectations of multiple shifting client organization members.

3.1 ANT research

ANT is one of the approaches situated within the sociology of science discipline. The fundamental assumption of this approach is that a wide range of social, scientific and technological factors are involved in the development of scientific claims and technological artefacts (Law 2012: 107). Examples of topics that have been analysed using ANT include: a claim that scallops anchor themselves and proliferate in an artificial shelter in St Brieuc Bay, France (Callon 1986), the development of a failed public transport system in France (Latour 1996) and the analysis of a UK aircraft project (Law and Callon 2000).

ANT is used as a method to follow a number of actors' successive interactions during the development of an artefact or claim. It is even regarded as "simply another way of being faithful to the insights of ethnomethodology" (Latour 1999: 19). As Latour (1999: 22) regards ANT as "a theory of the space or fluids", ANT researchers avoid making *a priori* assumptions about actors' properties (e.g. identity, role and interest) and presume that these actors, actors' properties and their interactions as dynamic and uncertain, which are constitute by *network*. A particular feature of ANT is that material objects are analysed as actors in the same way as people. Also, it does not posit a boundary between inside and outside of the system, organization or project (Callon 2012: 94).

A common starting point for ANT concerns the concept of the *heterogeneous network*, which assumes that a set of actors engages in the development of scientific claim or technological artefact. In this approach, the term *actor* includes individuals, organizations and/or material objects. For example, scientists, engineers, corporations, government agencies, research articles, and lab equipment may participate in the development of a technological artefact. The broad range of actions taken by these human and nonhuman participants constituted by *network* are interrelated in such a way that these actors contribute to the development of a specific claim or artefact (Law 1992). For example, to develop a specific claim, scientists may formulate a hypothesis and then engineers may fashion a device to investigate this hypothesis .Also, scientists may build an argument drawing on previous literature and conduct experiments using new devices to provide evidence for this argument.

A basic assumption of ANT states that networks change over time (Callon 1986), which is to say that interrelated actors, their activities and the relationships between them evolve as they develop a claim or an artefact. For example, as an example of changing interrelated actors, engineers improving the performance of a product may treat a combination of technical components of the product in a laboratory (thus the components become actors). By contrast, the same engineers assisting users and operators' operation of this product after a product is completed, may expect a particular function of the product which supports users and operators (thus users and operators become actors). In this way, actors in network change throughout the development of a product. As another example which illustrates changing interrelationships, engineers influence a machine when they modify its function, but the same machine may influence the engineers' technical claim when it proves its error by functioning a particular way against their theory. As this example illustrates, actors influence each other differently during the development of an artefact.

Actors may also attempt to change networks. For example, to conduct an experiment in a scientific institution, managers may engage engineers, equipment, and equipment operators. However, the engineers may want to use new machines for this particular experiment that requires additional safety controls. In response, the equipment operators may be reluctant to familiarize themselves with new machines, as using them would require additional training. In this case, the engineers resist the manager's proposed network, while operators attempt to maintain it. Furthermore, actors may sustain or resist networks in various ways. Law refers to this process as "overcoming resistance" or a "trial of strength" (Law 2002: 111). For example, the engineers in the above example may attempt to convince the operators of the benefits of learning to use the additional safety controls required for the use of the new machine. In response, the operators may accept this argument but attempt to equip the current machines with these additional systems. However, the current machines may be incompatible with these controls, rendering them useless. In this way, these engineers, operators, and the machines all attempt to influence each other to sustain or resist the proposed network.

ANT researchers use these concepts – networks, network changes and actor attempts to sustain or resist these networks – to pose various questions. For example, Latour (2000) studied how technological objects influence the activities of individuals. His analysis focused on how the tasks of people and material objects change in different contexts. For example, the role of door hinges is to enable a door to move to allow passage through a wall. However, the task of these same door hinges changes when a doorman closes a door to prevent wind from entering. An example more closely related to this thesis is Cowan's (2012) study of the selection of domestic technologies, which explores how actor interests influence the development of a technological artefact. Specifically, Cowan's study analyses historical changes in consumer decisions on competing heating and cooking systems in the United States. According to Cowan, the selection of various technologies can be explained by examining the interests of a number of actors, such as consumer interests regarding fuel costs and government interest in requiring particular fuels. Both of the studies above focus on the application or development of a technological artefact in everyday context in their study of network changes.

3.2 ANT application to projects

This thesis applies ANT to the development of a construction project. A number of ANT researchers have studied the development of knowledge or technological artefacts in project contexts. A number of well known ANT studies help to introduce how ANT is used to study the development of a project These include: Latour's study of innovative transportation system (1996), Callon's study of the cultivation of scallops (1986) and Law's study of Portuguese expansion (2012).

In his study of the failure of the French transportation system, Aramis, Latour (1996) investigated the successive challenges that arose in the development of this system, including site selection, the affect of budget constraints on design changes and component installation issues. Various actors, including politicians, engineers and technological components, were engaged in mitigating and managing these various challenges. To explain why the project failed, Latour investigated the involvement of different actors in these challenges, such as newly-elected politicians who were reluctant to fund the project, budget shortfalls and technological difficulties that became insurmountable.

Callon (1986) and Law (2012) offered even more detailed analyses of actor interactions in resolving challenges. Law (2012) investigated the development of Portugese galleys for ocean exploration in the fifteenth and sixteenth centuries, and how they dominated the Indian Ocean since spice trade started. Law specifically asked how these galleys could successfully navigate ocean currents while overcoming various forces of resistance. The analysis highlights how potential supporters and forces of resistance conflicted with each other in resolving successive challenges which happened throughout the exploration. These supporters and forces of resistance included: natural phenomenon, technical objects and people. During voyages, the challenge arose of navigating galleys against prevailing currents, a situation that involved compasses, sailors and celestial positions as supporting actors. Another issue concerned negotiations with Muslim traders, who often attempted to prevent these galleys from docking on shores under their control. This issue involved resistance of the Hindu ruler and translators, who spread hostile rumours, and the support of cannons and military power.

Another study is Callon's (1986) investigation the development of scientific claims that scallops anchored themselves and proliferated in an artificial shelter. He focused on an attempt by biologists to bolster these claims by drawing other actors into their programme. The biologists assumed a number of actors' interests: the fishermen were interested in the project of restocking the bay for their long-term economic interests, the scientific colleagues were interested in advancing the knowledge and the scallops were interested in surviving. Callon analyses four moments when the relationships between these relevant actors changed, which explain the biologists' capacity to persuade these actors to engage in their program. These moments are referred to as "problematization", "interessement", "enrolment" and "mobilization": (1) when biologists saw the engagement of a set of actors they deemed indispensable for developing the program; (2) when they persuaded these actors to act according to this program; (3) when the actors engaged with the program according to the scientists' wishes; and (4) when various spokesmen represented the fishermen, scientific colleagues and scallops in their respective interactions. Although this thesis does not explain each moment and a distinction between these moments in detail, the ideas similar to these concepts are mentioned later in this chapter.

The above studies illustrate the application of ANT to processes by which various actors and material objects engage with a number of issues throughout the development of an artefact or claim. Actors' interactions are analysed for the way in which actors engage and persuade each other. More specifically, actors who support one direction for the development of an artefact or claim and those who resist that particular direction conflict with each other during their interactions. Their capacity to engage and persuade other actors is analysed in the examination of such interactions.

3.3 Analytic concepts

This thesis conceptualizes a building project as a succession of negotiations between the broad range of project participants and material objects. Building on Callon (1986) and Law (2012), this thesis explores how actors persuade each other to choose certain alternatives over others. Analytic concepts central to ANT, including *problematization*, *interest* and *translation* were used to analyse how actors persuade each other to select alternatives..

The first concept, *problematization*, refers to an actor's attempt to address a particular issue. Problematization encompasses the network of relevant actors involved in that actors' proposal (independent of whether they agree to participate or not) as well as the interests and tasks that constitute this attempt. The concept is exemplified by Callon's study (2012) of the introduction of an electric car (VEL) in France. A group of engineers working for an electric utility company initiated this project; they outlined the project in technical publications and applied for funding to government agencies. Recognizing the difficulty of creating a new market for an electric car, the engineers' proposal depicted a society which required a solution for the urban problems of increasing air pollution and noise. In making this proposal, the engineers assumed that all relevant actors, including automobile manufacturers, government agencies and engine components (such as fuel cells and catalysts), would support it. Indeed, as part of their problematization, the engineers ascribed particular tasks to each of these actors: the Ministry of the Quality of Life would assist by regulating the level of acceptable noise pollution; manufacturers would produce the car; and electrons would jump between electrodes in a new type of electrochemical batteries which have lead accumulators to run its engines. All of these actors' engagement was indispensable for the success of the project. This example illustrates the ANT concept of problematization, i.e. the proposal to develop the car involved the identification of a network of relevant actors as well as their tasks and interests.

Within ANT, the term *interest* refers to actor expectations, concerns, motivations and goals with respect to a particular issue. Interests relate to a problematization insofar as the actors involved act based on these interests and advocate for certain positions on issues. For example, in the above case of the electric car, the engineers assumed that manufacturers would be interested in the prestige of being part of an innovative project, based on their own interest in developing an electric car. Thus, the manufacturers' interests were ascribed in such a way that it was given that they would accept the electric car proposal. However, by rejecting the opportunity, the interests of the manufacturers emerged and changed in response to the engineers' problematization. They became invested in maintaining their profits rather than changing their production line. Thus, based on their interests, the manufacturers preferred producing conventional buses to an electric car. As this example illustrates, different and changing actor interests can be analysed with respect to the engineers' problematization and the relevant actors' response to this problematization.

In the above example, the engineers have believed for three years that the project would be successful, however, this belief changed as relevant actors started opposing the engineers' problematization of the electric car. Initially, the engineers assumed that the manufacturers would support the development of an electric car, but in the end the manufacturers decided to maintain their production of buses, as they were interested in maintaining their profits from manufacturing conventional vehicles. Also, the engineers forecasted the high-performance fuel cells would be available by 1980s, thus opening vast market for the private transport. However, potential catalysts which were safe and cheap were found to be easily contaminated, rendering the fuel cells unusable. Hence, the relevant actors rejected the interests and tasks ascribed to them in the engineers' proposal, which led to the *translation* of this network.

Callon (2012) illustrates the failure of the engineers' problematization as a result of the translation of the network. The responses that led to the network's translation include the manufacturers' decision to produce conventional buses and the contamination of the catalysts. As a result of this translation process, the manufacturers' interests changed from those assumed in the engineers' problematization: they were more interested in maintaining profits than producing electric cars. As a result, the necessary actors were not persuaded to support the engineers' proposal, and the problematization failed. The three concepts – problematization, interest and translation – allow for the analysis of the range of actors' proposals, their different interests and how their interests changes, and whether actors' proposals succeed or fail as a result of these changes. In this thesis, translation of network is analysed as they make proposals (i.e. their problematizations) and as their relationships and interests change as a result of these proposals (i.e. the translations).

The definition of problematization in this thesis is similar to the concept defined in the early study of Callon (1980), in which a number of scientists from different laboratories successively strive "to define what is problematic and what is not" (i.e. problematization) and put forward their research proposals about fuel cells. However, Callon's (2012) study of the development of an electric car is used in the above explanation, as it involves a number of people and material objects and thus is similar to a building project. In his study of an electric car, Callon employs the concepts "simplification" and "juxtaposition" instead of "problematization". The combination of these two concepts has the same meaning as "problematization".

On the contrary, the definition of "problematization" in this thesis does not necessarily conform to "problematization" defined by Callon in his study of the cultivation of scallops (1986). More specifically, Callon used problematization as one of the four moments which illustrate changes in actors' relationships in the development of a scientific claim that scallops anchor. However, this analytical framework is not used in this thesis because Callon used these four moments to specifically trace changes in actors' relationships that explain the biologists' capacity to persuade these actors to engage in their program. Instead, this research traces a number of actors' persuasions and negotiations, and the way actors' interests are incorporated as a result of such negotiations. In terms of studying the incorporation of actors' interests, these "four moments" overlapped with each other. More specifically, actors' interests may or may not change as their relationships change, and their interests may or may not be incorporated at each moment. For example, "interessement" is one of Callon's "four moments" in which actors employ strategies to engage other actors. Another moment, "enrolment", is defined as a point at which actors persuade others to support their proposals. Although the distinction between these moments illustrates the impact of biologists' attempt on other actors, their interests may or may not change or may or may not be incorporated between these moments.

The definition of "interest" is explained by Callon and Law (1982) who argue that 'interest' in enrolment and networking theory approach (i.e. ANT) should be seen as "attempts to define and enforce contingent forms of social order on the part of actors themselves" (i.e. problematization). In other words, "interests" are factors for, as well as constituents of actors' proposals. Interests are analysed with respect to actors or their preferences for the resolution of an issue.

More specifically, interests and preferences are both analysed as the "intermediaries" of a network in this thesis, which are something that are circulated among "actors" to define each of their roles or activities (Callon 1991). It is worth noting that Callon's concept of "intermediaries" introduced here is different from Latour (2005: 39). Callon (1991) discussed intermediaries as constituents of actor-network, while Latour (2005) discussed them as one of the roles circulating objects have: carrying information without transforming meanings.

The concept of interest extends to material objects as well as people. For example, the catalysts involved in the development of the car did not support the engineers' problematization; rather, they were more "interested" in becoming contaminated than jumping between electrodes. As this example illustrates, the catalysts' interests reflected their opposition to the engineers' problematization. (Callon did not fully analyse the specific interests of material objects in this case study. However, he analysed the interests of scallops more clearly in another study of Callon (1986)).

In this way, this thesis treats people and material objects symmetrically in terms of their interactions. However, the actions of material objects are analysed only in relation to the incorporation of participants' interests. This position builds on Pickering (1993) who argue that material objects may attempt to block the path to actors' goals or to allow actors to achieve their goals, although he denied material objects' possession of intentions. For more discussion on the agency of material objects, see Collins and Yearley (1992) and Callon and Latour(1992).

3.4 ANT application to construction projects

A number of construction management researchers have applied ANT to construction projects. These researchers study how multiple actors, including clients, architects, engineers and contractors as well as architectural plans and engineering drawings are involved in various construction project discussions. Topics studied include: design decisions for safety (Lingarad *et al*. 2012), coordination of service design using 3D CAD software (Harty 2008), and the design of building form (Tryggestad *et al.* 2010).

Harty (2008) used ANT to develop the concept of "relative boundedness" in order to account for a process of the emergence of conflicts and their reconciliation which happen within or beyond particular organizations or projects. Based on his study of interactions between those including human and non-human actors, other researchers use ANT to highlight the role material objects play in project participant interactions (Sage *et al*. 2011). More specifically, Tryggestad *et al.* (2010), in their study of changing project goals, and Lingarad *et al.* (2012), in their study of successive interdependent decision-making processes, analyse the way material objects influence participants' interactions (i.e. mediator) and changing project goals. This is beyond another way in which material objects influence interactions: carrying information (i.e. intermediary) between people. Also, Sage, Dainty and Brookes (2010) studied the use of Project Management knowledge tools as prescriptive standards or interpretative tools. In doing so, these authors show how a range of actors, including people and objects, are involved in solving particular construction project challenges, which in turn document how these actors resolve different but interdependent issues. Although this thesis does not study participants' conflict beyond a project or the role of material objects, these authors' analysis of actors' conflicts over successive issues and the way these issues are solved provide insights into the analysis of the incorporations of actor interests in this thesis.

Lingarad *et al.* (2012) and Harty (2008) illustrate how actors favouring a range of solutions interact with each other in construction decision-making processes. For example, in the study of Lingarad *et al.* (2012), a client and contractor were in a dispute regarding structural columns damaged by fire. To address this problem, each party proposed alternatives: for safety reasons, the contractor recommended demolishing and replacing the damaged columns, but to complete the project more quickly the client insisted on repairing the columns. In the end, the client's proposal was chosen. In addition to project participants, material objects can also exhibit preferences. Harty (2008) studied the use of 3D CAD software in a construction project and illustrated how material objects can oppose people's proposals. For example, during the project, an issue regarding the coordination of heating and plumbing systems arose in the design process. However, the developers of the CAD software used for the project did not sufficiently address interoperability concerns[8] so members of the construction project team were limited in their ability to coordinate different applications, as the software did not allow for design coordination in compatible file formats. This case study illustrates how the CAD software and project participants' preferred solutions conflicted with each other for the issue of inoperability.

Several ANT studies also document how the solution to a particular issue may shape or constrain the solutions to another. The study of design decision-making processes by Lingarad *et al*. (2012) illustrates how design decisions can affect the health and safety of construction workers. In this case, the client's decision to repair the fire-damaged columns prevented the subcontractors from using prefabrication methods. As a result, the use of in-situ concrete required the structural engineers and

[8] *Interoperability* is a function that allows for format compatibility across software applications for file and data exchange.

column erection subcontractor's work at height. Prefabrication methods were not chosen because strengthening the columns involved the installation of new sections, the length of which varied depending on the extent of the column damage. This example illustrates how a decision regarding the treatment of fire-damaged columns constrained construction method options.

Furthermore, actor proposals may change over time, particularly when multiple actors are involved in resolving issues. Tryggestad *et al.* (2010) illustrate how actors shifted their proposals regarding the form of a skyscraper during the course of their design process. More specifically, the CEO of the housing associations decided to make the building taller than the initial design as it was difficult to absorb the sharp angles of windows due to the twist of the building. Then, the structural engineer raised a structural stability issue, resulting in the reinforcement and enlargement of the building's foundation. Finally, as the construction cost increased, the housing associations decided to change the interior design from customization to standardization. According to the authors' analysis, various actors, including the housing association, architects, structural engineers were engaged in changing the form of the building, as they were involved in resolving various issues in the project process, such as angles of certain windows and walls, the required structural strength of the building and increases in project costs.

Three factors influencing the project illustrated above – i.e. the conflict between actor proposals, interdependence between actor proposals and shifts in actor proposals – in turn, all contribute to ANT analysis of actor interests in decision-making processes. Particularly, these factors illustrate that some actor interests are given precedence in the course of decision-making processes. For example, in the case study of Lingarad *et al*. (2012), the client's preference for repairing the columns was chosen over the contractor's recommendation of replacing them. Thus, in this case, the client's interest in maintaining the project schedule trumped the contractor's safety interests. In addition, issues are often interdependent, i.e. decisions based on actor interests regarding a particular issue may shape or constrain the decision-making processes of another. In the case study of Lingarad *et al*.

(2012), the client elected to repair the columns based on his interest in maintaining the project schedule, which influenced the incorporation of subcontractor's safety interest, as the client's decision limited the subcontractor's choice of using prefabrication methods. In addition, actors may change their intentions over time, and that the interests of new actors may be incorporated to the detriment of those of previous actors. For example, as Tryggestad *et al.* (2010) report, as concerns over project cost increases arose, the housing association decided to change the project's interior design from custom to standard. In other words, a new interest in reducing project costs superseded the previous interest in tailoring the design to suit user preferences.

The above case studies illustrate that actors may hold different and shifting interests regarding issues and illustrate how actors' decision-making process about one issue can affect other project issues. In addition, these studies also provide insight into the analysis and incorporation of actor interests. However, they only analyse actor interests during his/her act of proposing solutions. For example, in Lingarad *et al*.'s study (2012), with respect to the question of repairing or replacing the damaged columns, the authors identify the contractor and the client interests with respect to their own proposals about the damaged columns. However, the authors do not study actor interests when they respond to other actors' proposals; the client interests could have emerged or changed in response to the contractor's proposal.

The ANT concepts of *problematization*, *interest* and *translation* allow for the analysis of different and changing interests in both actors' problematizations and other actors' response to them. For example, Ivory (2004) illustrated the use of these concepts by tracing changing actor interests through their response to a particular design proposal. Significantly, when ANT is applied to construction projects with a particular focus on actors' interests, the configuration of actors and their interests is studied as a *network* that develops around a particular issue. In this case study, the architects proposed an acryl wall rendering and a novel curved roof for a residential building project. They then attributed various actor interests in their proposal, or problematization, including their own interests in bolstering the firm's reputation for innovative design, the tenants' interests in the extra space afforded by the proposal, and the housing association's interest in funding the scheme. The architects then attempted to convince the tenants and housing association to adopt the proposal.

In response, the tenants supported the proposal by accepting the architects' assumption that they wanted extra space. In addition, new tenant interest in the aesthetics of the design emerged, which supported the proposed design. However, the housing association preferred a more conventional design based on their interests in ease of maintenance. In the end, based on tenant support, the housing association was compelled to accept the design scheme. This analysis reveals how relevant actor interest emerged and preferences changed in response to the architects' proposal.

Ivory's study illustrates how actors and their interests influenced each other with respect to a design proposal. In this case, the architect assumed tenant's interest and the housing associations' role, and represented client interests in the visual of acryl wall rendering. In response to the architects' proposal, the tenants' interests and the housing associations' preferred solutions changed. As a result of network translation[9], some actor interests (i.e. those of the architect and tenant) were incorporated into the design process and others were not (i.e. those of the housing association). The incorporation of actor interests into a proposal is analysed in the translation of the network surrounding a particular issue.

However, while Ivory's study illustrates the analysis of a single design discussion, the study of a building project involves a number of interdependent issues, which means decisions regarding particular issues may influence those of others. In other words, a fixed decision about a particular issue may shape or limit the proposed network of solving another issue, which again constitutes the network of actors and their interests. The network surrounding the solution of a particular issue

[9] The concept of translation is broadly used in ANT literature. ANT itself is called "sociology of translation", which refers to the dynamics of actors and material objects as well as their roles, interests and relationships (Law 1992). This thesis particularly focuses on changing interest in dynamic networks of actors, their interests and proposed solutions, in contrast to the focus on a changing set of actors.

becomes even more complicated in the course of a project as decisions about various issues become increasingly interrelated.

This thesis applies ANT to the study of decision-making processes about a number of design project issues. Actor interests are analysed as those that explain their preferences, and the incorporation of these interests is analysed as a selection of their preferences. The three concepts – *problematization*, *interest* and *translation* – are particularly useful in exploring actor interests in each issue. The application of these concepts to a range of issues provides a way to explore why some actor interests are incorporated during the course of a project whereas others are not. This analysis, in turn, affords a means to trace the incorporation of client interests among a range of actors and issues into the development of a building.

3.5 ANT application to client engagement studies

This study applied ANT to the decision-making processes that occur in the course of a building project. One advantage of applying the ANT approach is that it affords a framework to explore different and changing actor interests in detail. Actor interests were analysed by studying their problematizations and the responses of other actors to them. Another advantage to applying ANT is that the role of material objects can be analysed with respect to the incorporation of actor interests into building project. In other words, this research analyses how material objects support or oppose participants' solutions for issues.

In addition, applying ANT to building projects affords a novel approach to the study of client engagement, as it highlights the multiple actors and interests associated with the term *client*. First, it allows client interests to be analysed without making *a priori* assumptions of project participants. Generally speaking, over the course of a project various client organization members are involved with different issues; ANT allows those interests to all be analysed as those of the client[10]. For

[10] This particular analysis is related to the "mobilization", one of the four moments proposed by Callon (1986). Client "representatives" or "spokesmen" may change for each interaction.

example, client organization members may include CEOs, senior managers, project managers, owners and tenants. These members have different interests: a CEO with an interest in saving money may be involved in budget decisions, project managers with an interest in keeping a project on schedule may be involved in contractual arrangements, and owners with an interest in aesthetics may be involved in interior design decisions.

Second, ANT allows for client interests that are projected by other actors for a given proposal to be analysed. For example, architects, engineers and contractors may accept client wishes in support of their proposals (i.e. problematizations) regarding the design development and the selection of construction methods. Also, material objects may be used to represent the interests of clients and other actors' proposals, such as architect's assumption that a brief represents the client's interests. By studying the range of actors' problematization, a project team's assumptions of client interests (e.g. the architects' assumption of the tenants' interests in their problematization) for their proposed solutions are analysed. Thus, even in the absence of clients, this research analyses what can be categorized as "client interests" by studying project team members' proposals.

Finally, the impact of client engagement on the incorporation of these interests was analysed in this research, while maintaining a broad definition of these interests. This analysis will be based on the exploration of the incorporation of some actor interests over others in the course of a building project, which allows for the analysis of the incorporation of client interests among the range of actors.

To summarise, ANT application allows for the study of multiple and shifting client interests, and the exploration of client engagement processes which influence the incorporation of their interests among the range of actors and issues in the course of a project.

4 Research design

This research applies Actor-Network Theory (ANT) to the analysis of a building project. A university campus building project was selected, for which the client organization members (i.e. the clients) were actively engaged in decision-making processes. This project was analysed in terms of a number of discussions in which actors negotiated their preferences, an approach that provided a means to explore client engagement across a range of actors and issues over the course of the project. Data was collected from interviews and project documents and analysed to identify key issues with respect to the project and its relevant actors[11].

4.1 Project selection

Studying a single project provided an opportunity to analyse each discussion surrounding its development as well as the interdependencies between issues over its course. These interdependencies allowed for the analysis of complex processes in which client interests were incorporated into various decisions.

The project selection criteria were threefold. The first criterion was that a client organization had to be actively engaged, as diverse client interests are easier to trace in a project whose clients are involved throughout. The second criterion was that the project scale should be tractable; this study follows various participants' interests in detail, and the analysis of too many actors and complex engagement processes would quickly become impractical. For example, a large regeneration project of one district in London was also considered as a research subject, but was dismissed[12] because it involved too many participants and discussions, which would have necessitated studying only a particular stage of the project, not its entirety. The third criterion was that the project should have been completed close to the study time frame, because applicable interview participants and

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[11] ANT does not make *a priori* assumptions with respect to issues and relevant actors. Thus, the theory is regarded as "simply another way of being faithful to the insights of ethnomethodology." (Latour 1999:19)

[12] Another dismissed project was a property company's shopping centre project in the northern part of the UK. Although this project involved active client engagement and changes in client goals, the client was reluctant to disclose detailed information of the project, which was essential for this research.

documentation were more likely to be available. In the end, with the help of one University's Head of Project Management, a single campus construction project that met the above criteria was identified.

4.2 Project background

For the purposes of this research, the selected building project is referred to as "the SFD building" on the UK's Colmer University[13] campus. This building was designed to house facilities for the University's School of Film and Drama (SFD), and as such required the construction of special facilities, including theatre, film and TV production spaces. A project feasibility study was conducted in 2007 and construction was completed in 2011.

The background of respective University members involved in the project explains their level of active engagement in its development. At the time of this project's inception, the University's Estates Department had overseen construction of several campus buildings, and thus had already developed guidelines for University members' involvement and procurement methods. Also, the nature of the building's performance and specialized teaching spaces called for the SFD's direct involvement on the project team to help shape these facilities to meet its expectations. As a result, the SFD members were able to set requirements during project meetings; in fact, they had developed their requirements for new facilities over a period of decades, maintaining the need for upgraded facilities superior to those they previously occupied (SFD Head interview, April 2013). Consequently, the project team members were motivated to meet the SFD's expectations in a collaborative team environment (Architects' interview, April 2013).

The project originated from Colmer University's Estate Strategy (2004-2013), which promoted more efficient use of University spaces. The Estates Strategy objectives were guidelines for capital development within five-year time frame, one of which was to consolidate campus activities on the

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[13] To maintain confidentiality, the names of the University, the building project and all participants have been changed for this study.

main campus and close a satellite campus. However, in order to close this campus, the SFD (which was located there) would require a new building. As a result, the new SFD building was conceived so that the School could transfer its activities to the main campus, specifically within the campus' arts and humanities zone. University members initiated the project in 2007, and client organization members included SFD members, the Board of Governance (BG), the Dean of Faculty (DF), the Head of Space management (HoSM) and an internal project manager (PM) from the Estates Department.

For the purposes of this study, establishing the background of client team members and their formal project roles was helpful in identifying their general motivations[14]. As a future resident of the new building, the SFD representative was appointed to advise this project, and her role was to communicate the needs of the School's academic staff, technicians and students. The representative was particularly interested in the SFD's requirements for the theatre spaces, as they involved her teaching and research. The Board of Governance (BG) is the executive body of the University whose members included the Vice Chancellor, the Deputy Vice Chancellors, the Deans of Faculty and the Heads of School. These administrators were regularly involved in reviewing the project, particularly when decisions were made with respect to the campus master plan and the budget. Their interests focused on the effect of the project on the University at large. The Estates Department managed the campus estates, including maintenance, landscape and new capital projects. Within this Department, the Head of Space Management (HoSM) was in charge of managing spaces in buildings across campus, and thus was tasked with efficient use of University property. The internal PM served as a liaison between the SFD representative, the BG and other project team members. In addition, his interests involved completing the project on time and within budget while satisfying University requirements.

[14] This research traces changing client interests at particular moments of the project, rather than their general motivations. However, understanding of the background of each client participant and their general roles aids in analysing their interests that emerged with respect to each specific context.

A range of project team members were also involved in the project, including an external PM, architects, services and structural engineers, a contractor and an acoustician. Regarding procurement methods, the University engaged in framework contracts[15] every four years with various project management, architectural, engineering and construction companies. For each capital project, the Estates Department selected firms from a competition among three or four companies which are within the agreed framework. In July 2008, just before the concept design phase, architects, services engineers, structural engineers, contractors and an external project manager were involved in the SFD building tendering process. The project's architectural firm was selected based on its experience in designing theatre facilities for educational institutions and the SFD representative's sense of being able to easily communicate with its staff (SFD representative interview, April 2013). In October 2010, several construction firms went through a tendering process before the start of the construction stage. In the end, the firm that was involved in the concept design process won the project bid.

4.3 Data collection

ANT was used to analyse the building project as a number of discussions in which relevant actors negotiated their proposals. The study data collection served both to identify issues that resulted from such discussions and the actors involved. An initial group of participants was interviewed, and the names of additional interviewees were identified through these interviews. In addition, each interviewee provided applicable project documents useful to the study.

4.3.1 Interviewee selection

To begin, each client (i.e. the University) member was interviewed, including the SFD representative, the SFD Head and the internal PM. An additional interview with the Estates Department PM at an

[15] The University, as a public sector, had to go through Office Journal of European Union process (opening tender for firms in a whole Europe) for a project which was more than a certain financial threshold (£300,000, according to the interview with the Head of Project Management in March 2013). In order to avoid undergoing this procedure for each project, the University selected three or four companies as candidates every four years to simplify a tendering process.

early stage of the study was particularly useful, because it introduced the breadth of project team members, and thus helped to narrow the list of further interviewees as the data collection phase proceeded.

The initial interviews yielded the key discussions and further relevant actors. For example, the SFD representative identified the architects as significant actors with respect to space allocation decisions. Also, it turned out that the internal PM participated in discussions between the architects and the services engineers regarding the size of the mechanical space. The interviews with these participants resulted in the identification of two key project issues: space allocation and mechanical space size. Also, these interviews led to the identification of the architects and the services engineers as the relevant actors involved with these issues.

In total, 13 interviews were conducted with project participants. While the external PM, the BREEAM coordinators and the quantity surveyors were identified as relevant actors in the project, they were not included in the interview sample, because speaking with them was not likely to yield further key discussions[16].

4.3.2 Interview procedure

Interviews were conducted from March to October 2013. Each participant was interviewed in his or her office for one to two hours, and the interviews were audio recorded with the interviewees' permission. During the interviews, the research project title was introduced as "client participation in decision-making processes[17] over the course of a project" to client team members. In contrast, it was introduced as "stakeholders' participation in decision-making processes over the course of a project" to project team members. The client engagement focus of this research was not explained to other stakeholders to avoid making them feel obligated to discuss information related to the

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[16] Discussions that involved these additional potential interviewees seemed either to overlap with other participants' involvement or be too far removed from other participants' involvement. These issues did not meet the criteria for the selection of key issues (see 4.4.1).

[17] Although the research was introduced as a study of decision-making processes, interviewees talked about their participation processes in general, including negotiation, persuasion and challenges in the project.

clients, as this study concerns the range of project participant expectations without privileging client perspectives.

To identify key project discussions and relevant actors from their accounts, interviewees were encouraged to freely discuss their participation. Interview questions were crafted to prompt conversation, and included queries such as “What was your role in the project?” and “How did you get involved in the project?” As they explained their relationship to and role in project process, several key discussions emerged, and the interviewees were asked about their engagement in these discussions. Specifically, to introduce such questions, particular discussions mentioned by the previous interviewees were mentioned, and project documents which had been gained from previous interviewees were shown during the interviews to help stimulate conversation. Particularly, the SFD representative showed around the SFD building during the first interview, and explained discussions and challenges related to each room. Seeing the physical building was very helpful to draw her memories, and specifically understand the project process as well as the completed building design as the outcome of these discussions. While detailed questions were often effective in drawing out interviewees’ memories, they sometimes pressured interviewees who may not have remembered details or were reluctant to explain them. For example, the SFD representative was interviewed for the second time to glean information about particular discussions, such as those regarding the mechanical space size. However, she did not remember these discussions, even though the SFD’s involvement in these discussions was mentioned by other participants.

4.3.3 Document collection

The interviewees were asked to provide project documents relevant to their discussion for use during their interviews. For example, the contractor brought information pertaining to the choice of brick suppliers, and structural engineers provided documents about the structural design of beams. These documents helped inform the understanding of various project discussions and challenges. By contrast, the internal PM provided a variety of documentation related to issues beyond those discussed during the interviews, including architects' sketches, presentation slides, and the structural engineers' appraisal options for strengthening columns. These records not only helped inform the understanding of decision-making processes but also the identification of new discussions and relevant actors.

This project information was used for various purposes. For example, briefing documents and a series of architectural drawings were studied to understand when and how space allocation decisions changed during discussions between the architects and the SFD. In addition, meeting minutes were particularly useful for understanding the timelines of a number of issues during the design stage. Furthermore, progress reports and emails were used to analyse project participants' interests as a basis of their proposals.

Table 4-1 below summarises this data collection history, including the order of interviews, the identification of additional relevant actors identified by each interviewee, and the documents collected.

Table 4-1 Identification of relevant actors and document collection for each interview

Dates (2013)	Interviewee	Relevant actors	Documents collected
19 March	Head of Project Management	SFD representative, SFD Head	Campus master plan, User representative guide,Estate strategy
3 April	SFD representative	HoSM, PMs, architects, lighting specialists, structural engineers, DF, technicians	
8 April	SFD Head	HoSM, architects, contractors, acoustic engineer, DF	
11 April	Deputy Vice Chancellor	SFD, PM, Financial Officer	
16 April	PM	SFD, Financial Officer, architects, services engineers, contractors	Brief, location proposal, design scheme, services engineering reports, HVAC options, site preparation, acoustician's review notes, cable net structural options, various email messages
17 May	Services engineer	SFD, architects, lighting specialist, acoustic engineer, structural engineer	Services engineering drawings
7 June	Architects (lead architect, sub architect, architectural technician)	SFD, PM, BG, services engineers, lighting specialist, acoustician, structural engineer	
26 June	Master Plan PM	SFD, PM, public	Public presentation boards, responses to public consultation
3 July	Financial officer	Deputy Vice Chancellor, BG	
27 July	SFD representative		Meeting minutes, architectural plans and elevation, lighting drawings, tendering information
1 August	HoSM	SFD, Borough councils, feasibility group, University administration members	
28 August	Structural engineer	Architects, contractors, cable net specialists, SFD technicians	Structure engineering drawings, structure engineering reports, Structure CAD data
18 Septembe r	Contractor	SFD, PM, BREEAM coordinator	BREEAM documents, site waste management, various email messages, discussion notes, brick specifications
11 October	Lighting specialist	SFD, technicians, services engineers, contractor	

4.3.4 Ethical procedures

This study has been subject to ethical review by the University of Reading Ethics Committee, and a number of potential ethical issues involved with this research were considered and managed. First, because study data could potentially harm project participants, the names and identifying features of participants and organizations (including those of the University and firms involved) were changed so their identities remained confidential. Second, a potential risk involved the effect this research could have on the relationships between the University and participating companies or between University stakeholders. To minimise this risk, all interviewees were told that this information was to be used only for academic purposes and that they could refrain from answering any interview question. This procedure was communicated in writing to each interviewee, and each signed a consent form was to document his or her understanding. Also, interviewees were given the option to review their interview transcripts and make changes as they saw fit. Finally, architectural floor plans and diagrams used in the project were transformed into a simplified form in this thesis in order to maintain anonymity of the building and the project.

4.4 Data analysis

Data was first analysed to discern the rich and complex key discussions and challenges that emerged during the course of the project. As a result, a number of discussions were evaluated and chosen for analysis. During this analysis, an analytical framework was developed to allow for the study of changing actor interests.

4.4.1 Selection of key discussions and issues

As discussed above, interview data and project documents were analysed for this research. Table 4-2 presents the key discussions and issues that arose during the project, the project timeline and the main participants identified in the data. Following the identification of these discussions and challenges, the qualitative analysis software package NVivo[18], was used to code the data and identify the key discussions that related to project participant negotiations.

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[18] NVivo is a software which allows for a coding of a variety of data including "Word documents, PDFs, pictures, database tables, spreadsheets, audio files, videos (imported video files and YouTube content), social media data and web pages" (QRS International Pty Ltd. 2014). In this research, this software was used to organize the data including interview transcripts and project documents for each coding theme.

Table 4-2 Timeline of key discussions and challenges in the SFD building project

Key discussions and challenges	Main participants	Date
Feasibility study	Feasibility group members, including Deputy Vice Chancellor, financial officer, SFD, HoSM (occasionally Heads of School, Dean of Faculty)	Apr 2007-Mar 2008
Discussion of SFD building location (during feasibility group meeting)	Feasibility group members	Aug 2007
Public consultation of campus master plan	Members of the public	Dec 2007
Initial brief	SFD	Feb-Mar 2008
Decision about building location	Feasibility group members	Mar 2008
Project meeting kick-off Start of site preparation discussion	SFD, PMs, Architects, Structural engineers, Services engineers, Cost consultants, CDM coordinators	Jun 2008
Finalising brief	SFD, PMs, Architects	Jun 2008
H&S meeting about high access platform in theatres	SFD, theatre specialist, CDM coordinators	Jul 2008
Design workshop (from initial sketch to option appraisal for budget decision)	SFD, PMs, Architects	Jul-Sep 2008
Project budget decision	BG (Deputy Vice Chancellor, Financial officer) PMs	Nov 2008
Discussion of various issues in architectural concept design scheme	Project team members	Dec 2008-Feb 2009
Presentation of final concept design	Project team members, University stakeholders	Feb 2009
HVAC scheme design	Services engineers	Feb 2009
Consultation of acoustic engineer	PMs	Mar 2009
Discussion of options for theatre ventilation system	SFD, Services engineers Architects	Apr 2009
Structural options for a cable net system in theatres	SFD, Structural engineers	May 2009
Cost review meeting	Project team members	May 2009
Final report on acoustic design scheme	Acoustic engineer	Jun 2009
Finalising architectural plans	Architects	Jul 2009
End stage report of scheme design	Project team members	
Completion of detailed design	Project team members	Sep 2009
Further discussions over acoustic treatment of a mechanical space over performance spaces	Acoustic engineers	Oct 2009
Planning application, discussions over BREEAM	Borough councils, Estates Department	
Finalising tendering information	Project team members	
Tendering, Procurement arrangement	Estates Department	
BREEAM workshop	Project team members, BREEAM coordinators	Apr 2010
Start of construction	Contractors, subcontractors	Oct 2010
Construction completion	Contractors, subcontractors	May 2011
Building occupation	SFD, PMs	Apr 2011
Building opening	University stakeholders	Jun 2011

The identified discussions included the building location (March 2008), space allocation (June 2008 - February 2009), project budget (November 2008), ventilation system (April 2009), cable net system design[19] (May 2009), acoustic design and value engineering issues that arose during the detailed design stage (September 2009). A number of discussions that resulted prior to the construction stage were also identified, including site preparation and achieving a BREEAM rating. Key issues were not identified for the construction stage.Throughout the coding process, interdependencies between issues were analysed. For example, the SFD chose a ventilation system for the theatres, which influenced the services engineers' calculation of the size of mechanical size. These issues were grouped and coded as a single theme, i.e. "mechanical space size". The classification of issues into separate groups was often not clear. For example, office space layout issue could have been included in "space allocation" instead of "mechanical space size", and shared use of Purbeck facilities could have been included in "space allocation" instead of "building location." In the end, the issues were grouped in a way that the analysis of each group revealed different types of processes behind how actors' interests were incorporated into project decisions[20].

These groups of issues were selected as main decision-making process topics[21] for the project according to two criteria. The first selection criterion was that topics had to be among those most frequently discussed by interviewees as well as those rich in project documentation. The second criterion was that numerous and changing actor interests – particularly client interests – had to be able to be clearly analysed from the available data. Table 4-3 below shows the four topics that met the first criterion: building location, space allocation, cable net system design, and mechanical space size. Each topic involved a number of issues that were recalled by various interviewees. For example, the building location topic involved decisions about location, site preparation and the shared use of the Purbeck facilities. The space allocation discussion involved the size and location of Theatre 1 and

[19] A cable net system is a platform for controlling the direction and position of ceiling theatre lights.
[20] See the end of this chapter for this explanation.
[21] In this sense, the term "topic" is used to refer to groups of issues. However, the meaning of *topics* is the same as that of *issues*, in terms of referring to those that are subject to discussion and about which decisions are made.

various other spaces. The cable net system design topic involved the structural design of columns and coordination of various systems. The mechanical space discussion involved the selection of the ventilation system, the mechanical system location, the setting of sound proofing levels and the acoustic design of the of the mechanical space floor. However, while the cable net system design topic involved a number of decisions, the actor interactions involved were deemed too complex for analysis. Besides, client interests were not clearly analysed in this topic. As a result, only three of the four topics – building location, space allocation and mechanical space size – were selected for analysis.

Table 4-3 Key issues and topics identified from each interview

<table>
<tr><th></th><th>Location</th><th>Space allocation</th><th>Cable net system design</th><th>Mechanical space size</th></tr>
<tr><td>Head of PM</td><td>Building location</td><td></td><td></td><td></td></tr>
<tr><td>SFD representative</td><td rowspan="3">Building location, shared use of Purbeck facilities</td><td>Theatre 1, storage space, breakout space, windows, project budget</td><td>Column design</td><td></td></tr>
<tr><td>SFD Head</td><td>Meeting room, project budget</td><td></td><td>Sound proofing levels, exposed ducts</td></tr>
<tr><td>HoSM</td><td></td><td></td><td></td></tr>
<tr><td>Deputy Vice Chancellor</td><td rowspan="4">Building location</td><td rowspan="2">Project budget</td><td></td><td></td></tr>
<tr><td>Financial Officer</td><td></td><td></td></tr>
<tr><td>Master plan PM</td><td></td><td></td><td></td></tr>
<tr><td>PM</td><td>Storage space, project budget</td><td>Health & Safety</td><td>Acoustic design, mechanical system location</td></tr>
<tr><td>Services engineer</td><td rowspan="5">Site preparation</td><td></td><td></td><td>Ventilation system, duct routes</td></tr>
<tr><td>Architects</td><td>Theatre 1, storage space, breakout space, windows, building exterior</td><td></td><td>Mechanical space size/ location, acoustic design, duct routes, sound proofing levels</td></tr>
<tr><td>Structural engineer</td><td>Floor system design</td><td>Column design</td><td>Beam design</td></tr>
<tr><td>Contractor</td><td></td><td></td><td>Mechanical space location</td></tr>
<tr><td>Lighting specialist</td><td></td><td>Coordination of various systems</td><td></td></tr>
</table>

4.4.2 Development of analytical framework

The analytical framework was developed through a review of relevant theory and data exploration. Initially, prior to adopting the ANT approach for this study, the Social Construction of Technology (SCOT)[22] was considered as an analytical framework, which can be used to analyse the development of a building as a list of successive problems and solutions. More specifically, according to this method, a building project is examined as a number of participants' interactions (including client and project team members) to define and solve problems within various participants' interpretations and interests. Participants' interests are then analysed according to their solutions across alternative options.

However, as the data collection process proceeded, this analytical framework became difficult to apply. A question as to what precisely constituted "the building", a designation that developed through relevant participants' problem-solving processes, changed over the course of the project. More specifically, the object which was subject to development changed from building sites, various spaces in the building, various building components, and finally to a number of drawings and other documents. Hence, it became difficult to define what was meant by the development of "the building" while so many material objects were simultaneously involved in decision-making processes. Besides, these objects are involved in participants' interactions in various ways. For example, drawings represented the development of the building within discussions between the SFD and the architects, functional spaces were used by architects to define problems about the space allocation, and building components became solutions to the problems for structural engineers about the choice of construction materials. Such a variety of roles of material objects in participants' interactions are not analysed using SCOT.

[22] According to Law (2012), a main feature of SCOT is that it assumes that social factors are dominant in the explanation of a development of an artefact or a claim. In contrast, ANT assumes that other factors such as natural, economic, or technical factors may resist social interests, and thus, dominant factors should be determined from the empirical study of interactions between heterogeneous elements.

On the other hand, ANT allows for the analysis of a number of material objects with different roles. Specifically, in order to analyse actors' interests, ANT analytical concepts – problematization and interest – were used to analyse the engagement and negotiations of actors (including both participants and material objects) in various discussions. These concepts were used to analyse the changing configuration of actors, their interests and proposals. Thus, this analysis highlighted how material objects were involved in the process as actors or other participants' proposals. In other words, this work examined how the involvement of material objects changed over the course of decision-making processes, and thus, the way they influenced the incorporation of actors' interests.

4.4.3 Analysis of actor interests for each topic

These three ANT analytic concepts – problematization, interest and translation – were applied to the selected project topics discussed above: building location, space allocation, and mechanical space size. These concepts were used to analyse the incorporation of interests across the changing configuration of actors, and their interests, proposals and decisions regarding various issues with respect to each decision-making process. In particular, this analysis focused on 1) various actor interests, 2) how actors, their interests, their preferred solutions and decisions influenced each other, 3) the incorporation of some actors' interests over others.

A diagram is drawn for each discussion or negotiation to illustrate the incorporation of some actors' interests over others. Figure 4-1 shows an example of a diagram of a presentation. A project team member X (represented by a white circle at the top) proposes that a client Y (represented by a black circle) choose Option A[23] (white circle through which solid lines penetrate) over Option B (white circle through which dotted lines penetrate). As a result, some actor interests which support Option A are incorporated over those which support Option B into a decision to choose Option A.

[23] This diagram is consistent with the concept of interest and preferences defined in Chapter 3. Following Callon (1991) this thesis regards actors and intermediaries (preferred options, interests) which define actors by circulating between each other constitute actor-network.

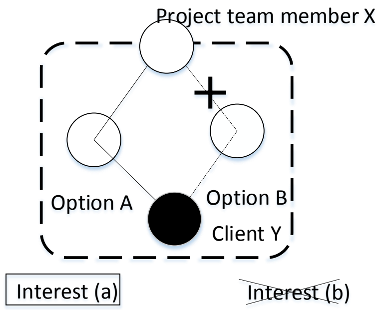


Figure 4-1 Project team member X's problematization (example)

This diagram helps to understand how the configuration of actor interests, proposals and decisions changed in the course of a decision-making process for each topic. The diagrams of a number of discussions highlight the feature of dynamic configuration in each topic, and thus, the types of decision-making processes. Based on the types of decision-making processes highlighted by the diagrams, each of the three topics was divided into a succession of key moments (and thus do not necessarily follow a chronological order). The first topic, building location, involved the client team members who successively changed their preferences with respect to the location. Here, the distinction between moments was analysed with respect to how actors iteratively made their proposals at each moment. By contrast, the second topic, space allocation, involved discussions regarding the size and relative location of a number of spaces. In this case, proposals were interdependent, thus the distinction between moments was analysed in terms of how a proposal for one issue influenced those for others. Similarly, the third topic, mechanical space size, involved successive interdependent issues. The distinction between moments was analysed with respect to how the fixed decisions about a particular issue influenced proposals about the subsequent issues which were not yet to be set.

Three decision-making processes spanned the feasibility, concept design and detailed design stages of the project, and the level of client engagement varied by issue: client team members may propose solutions, support or oppose the proposals of other actors, or be entirely absent from decision-making processes. While client engagement may vary, the way client engagement influenced the incorporation of client interests was analysed in a decision-making process with respect to each project issue. The exploration of the incorporation of some actor interests over others allowed for the analysis of client engagement processes which influenced the incorporation of their interests among the range of actors and issues in the course of a project.

5 Building location

Deciding the location of the SFD building involved a number of University members (i.e. clients) at different points of time. At the beginning of this process, the Head of Space Management (HoSM) and the master plan architect proposed multiple potential locations for the SFD building and ultimately recommended placing the structure east of the Purbeck Building. However, after the exhibition of the draft campus master plan, members of the public opposed this location. As a result, the University's Board of Governance (BG) and its feasibility group (FG) finally decided that the SFD would be built on a former car park site, which overruled the Dean of the Faculty's wishes. Additional concerns arose as a result of the final building location decision. Table 5-1 lists an abbreviated timeline for the decision-making processes and the key actors involved.

Table 5-1. Timeline of key moments in the decision-making process of siting the building

	Decision-making process	Actors	Date
5.1	Initial building location proposal	HoSM, master plan architect	Jul-Sep 2007
5.2	Public opposition to the east site	Members of the public, campus map	Dec 2007-Mar 2008
5.3	Final decision on the building location	Dean of the Faculty, FG members, BG members	Mar 2008
5.4	Issues which arose as a result of the decision about the building location	HoSM, SFD, Estates Department, project team members	Jul 2008-2010

This chapter traces how different client interests were raised and impacted on building locations. As client interests which emerged at different times conflicted with each other, only some of client interests were incorporated into the final decision.

5.1 Initial building location proposal

The FG members began discussing possible SFD building sites in July 2007. The group asked the HoSM to identify a set of initial options. In response, the HoSM recommended five potential SFD building sites, each with a number of advantages and disadvantages. Her criteria[24] included 1) proximity to the Purbeck Building, 2) sufficient space availability for the SFD's academic activities, and 3) the feasibility of construction work, such as the partial demolition of an adjacent building (Head of Space Management report, August 2008).

Throughout this process, the HoSM considered proximity to the Purbeck building as her most important site selection criterion, as it satisfied the two Estates Strategy objectives. Estates Strategy objectives were set out every five years as guidelines for the University to develop its campus estates. One of the objectives which the HoSM raised was to encourage academic integration between Schools and Departments with related academic activities. She reasoned that locating the SFD building close to the Purbeck Building could encourage this integration between the SFD and the School of Arts and Communication, because the School, which had a collegial working relationship with the SFD, occupied the Purbeck building at that time. Another objective was to maximise the use of existing space. Placing the SFD building next to the Purbeck building would allow for shared use of the Purbeck building's facilities, including its theatre and teaching space.

Of these five potential sites, the HoSM eventually recommended siting the SFD to the east and west of the Purbeck Building, which satisfied both of the Estates objectives. One of the dismissed options was to refurbish an existing building, which satisfied the second estates objective of maximising the use of the existing space, but not the first, as the existing building did not house a School with a close relationship with the SFD. Besides, it would have been impossible to accommodate the SFD's special requirements of theatre and screening facilities into the existing structure. In making these recommendations, the HoSM assumed that the University administration supported the estates objectives of fostering academic integration between schools and departments and maximizing use

[24] The HoSM's interests were not analysed with respect to all of these factors. This research analysed the HoSM's interests, which directly related to her selection of the eastern and western sides of the Purbeck Building.

of existing space. These objectives, in effect, drove her proposal of the east and the west sites as building locations.

After these initial decisions were made, the HoSM asked the master plan architect, who was involved with designing the campus master plan, to review the merits and drawbacks of the east and west sites. This master plan was being developed at the time of the SFD building project's feasibility meeting, which envisaged the construction of a number of future campus projects, including the SFD building.

The master plan architect favoured the east site over the west site based on his interest in improving the campus centre. He identified two advantages of locating the SFD building on the east site. The Purbeck Building, east of which is open green space, is located at the centre of the campus. Thus, he maintained that the new structure could potentially foster a more vibrant civic atmosphere for this central green space, as the building was planned to accommodate public theatres and could thus be promoted as "the heart of the University campus"(Master Plan Architect report, August 2008). Second, the architect suggested that constructing the building within this green space would divide the space into two distinct areas, thereby strengthening and defining the function of each area to campus users and visitors.

In contrast to the east site, the architect did not recommend the west site as he identified a disadvantage of this site as being next to a listed building. He maintained that placing the new SFD building on this site would invite a visual contention between the SFD building and this building, and was concerned because he planned to design the SFD as an iconic building to stand on its own.

However, the architect identified a few drawbacks of locating the SFD building on the east site. For example, the architect knew[25] that some of the University administration members, including the Dean of the Faculty and the Heads of School, were quite interested in campus accessibility to the new SFD building for visitors, and the east site was not visible from outside the campus. The new

[25] The architect interviewed University administrators during the development of the campus master plan.

SFD building was planned to accommodate a public theatre space as well as a teaching space to be shared among different schools and departments, activities that would ideally happen in a visible and public location within the campus. Therefore, the architect assumed that these administrators would support the west site, which faced the main University entrance, as the building location.

Based on these conclusions, the architect advocated for the east site in a formal report and attempted to persuade University administration to change its preference. At the end of this report, he stated:

> … [the SFD's] location will therefore be influenced by whether the University wishes to encourage visitors into the heart of the campus, or whether it would prefer to maintain a degree of separation by locating it at the periphery of the built core.
>
> (Master Plan Architect report, August 2008)

This statement suggests the architect's strategy of attempting to persuade the University administration of the merits of the east site. He cited the University's interest in drawing visitors into the campus centre, instead of its interest in the visibility of the building from outside the campus, in a way that it could support the choice of the east site. The architect also implied that construction on the west site would mean moving the building away from the campus centre. As a result of these recommendations, the HoSM and the other feasibility group members agreed with the architect's proposal to select the east site.

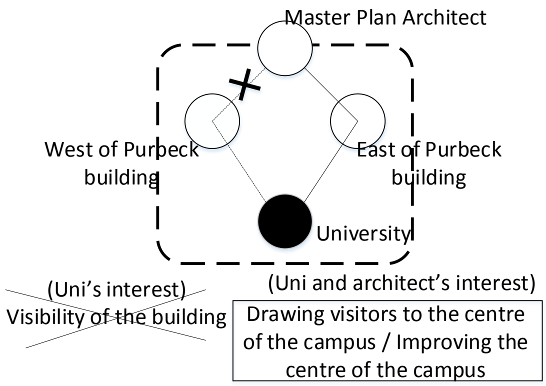


Figure 5-1 Master plan architect's recommendation of the east over west site[26]

To summarize, the master plan architect proposed that the University choose the east site (represented by solid lines) over the west (dotted lines) (Figure 5-1). In advocating this position, the architect assumed that the University was more interested in drawing visitors to the campus centre, a requirement fulfilled by the east site, than in the visibility of the building, a requirement supporting the west site. Ultimately, the University administration chose the east site, which incorporated both the architect's interest in improving the campus centre and the University's interest in drawing visitors into this centre. As a result, however, the administration's desire to make the building visible from outside the campus was not fulfilled.

5.2 Public opposition to the east site

In 2006, the campus master plan team[27] developed its draft plan, which was approved by the University's administration. In December 2007, the University Estates Department's Master Plan Project Manager (PM) organized a six-week public review exhibition of the draft plan.

During the exhibition, community members, staff and students were invited to view the campus master plan at a venue in one of the main campus buildings. The master plan was presented on twelve presentation boards that illustrated its background and purpose along with vehicular routes

[26] An actor is represented by a white circle, and a client is especially represented by a black circle. The master plan architect ascribed the University's preferred option (transparent white circles) over another in his problmeatization (represented by a rectangular).

[27] The team comprised a variety of specialists, including landscape architects, transportation specialists, services consultants and quantity surveyors.

and the condition of various buildings. Importantly, one of these boards presented the 13 key themes of the campus improvement plan, including new building projects, one of which was the SFD building. Another board showed the name and location of 33 future campus construction projects superimposed on the campus map. On this map, the proposed location of the SFD building project was depicted in the middle of a green space, east of the Purbeck Building. Figure 5-2 is a diagram showing a section of the campus map that was presented in the public exhibition indicating the location of each project and listing its name in a table at the bottom right corner.

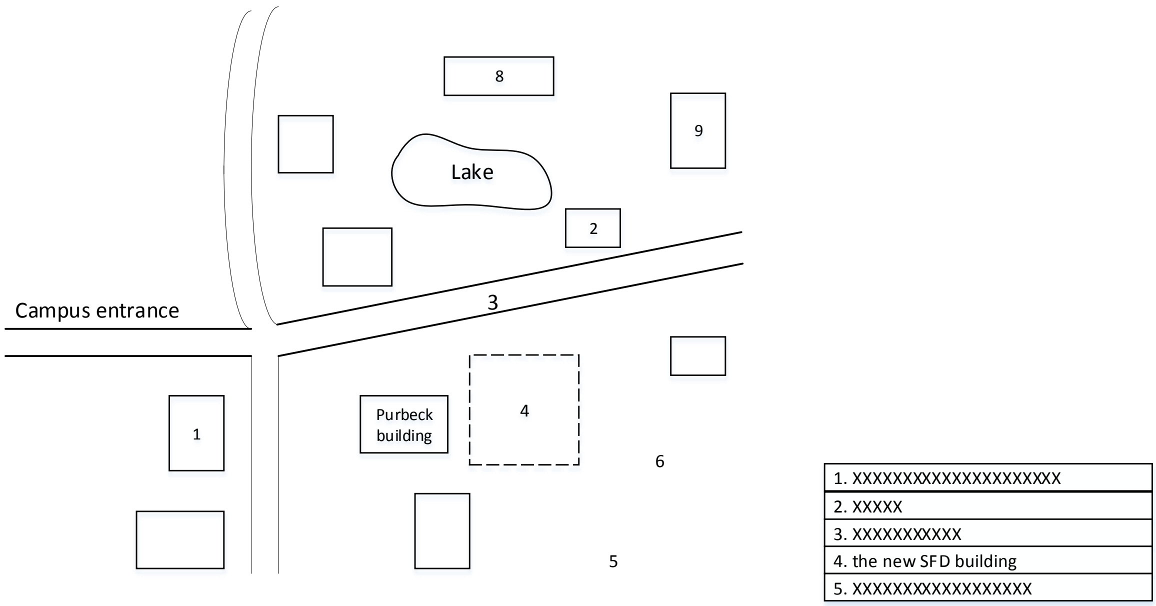


Figure 5-2 Diagram of a section of the campus map showing the proposed SFD location[28]

The purpose of the public exhibition was stated on the first presentation board:

> In order for the planning authorities to properly consider the Campus Master Plan, the University needs to consult with a range of statutory and non statutory bodies, local people and interest groups to enable their views to be taken into account. This will enable them to consider what the University is proposing in the light of the consultation response.
>
> (Campus Master Plan Development Team presentation, November-December 2007)

While this statement suggests the campus master plan development team's interest in satisfying the local authority's requirement of community engagement, they did not intend to involve the public in

[28] This figure was created by the author for the purpose of diagramming the campus map layout and thus does not represent the actual University campus map analysed for this research.

discussing the details of each plan. Thus, the presentation boards were designed in such a way that they did not communicate the potential functions of the SFD building; for example, they did not state that the SFD would house the public theatre or shared teaching spaces discussed in previous project feasibility meetings.

During the exhibition, forms were distributed to record public comments on the 13 key themes of the plan. Attendees were asked to comment on these themes and to either leave these comments at the exhibition venue or return them online or via post. Of the 13 themes, two related directly to the location of the SFD building: Theme 4, "*to reinforce the square at the centre of the campus*" and Theme 7, "*to provide a new School of Film and Drama building*". The phrase "square at the centre of the campus" in Theme 4 referred to the central green space that was to be divided into two spaces by the construction of the SFD building.

After the exhibition, the development team collected comments and reported the results (Campus Master Plan Development Team report, July 2008). One result of this public comment period revealed that a majority of respondents, particularly students, opposed the proposed site for the SFD building because of the loss of the green space that would result in its construction. In particular, regarding Theme 4, there were only 10 positive responses out of 56, 35 of which were from students and staff. Comments on Themes 4 and 7 included statements such as "will have serious negative impacts on our ability to recruit students if green space is removed" (University employee and resident RU12[29]); "very obtrusive location – cutting in half one of the few well planned open spaces on campus" (University employee, U28); and "should not be built here under any circumstances – would make university look cramped and darker" (University student, S18). These comments suggest that the majority of respondents opposed the proposed building location out of protection for this

[29] The comments for each theme were listed in the report. These comments were classified between those from residents (R), university employees (U), and university students (S), including those who have overlapped roles (e.g. RU, US). Also, they numbered each respondent.

central green space, and clearly some respondents were invested in maintaining the open and bright qualities of this space.

On the other hand, a few respondents, particularly staff members, supported the proposed building location as appropriate, as this site was at the centre of campus. However, this support seemed to be based on the condition that the new SFD building facilities would be shared across schools and departments. In this regard, comments included “Seems reasonable – will facilities be open to others?” (University employee and student, SU3) and “Appropriate, providing other departments have access to facilities” (University employee and student, SU4).

In addition, a minority of respondents requested more information about the proposed building in order to make a more informed assessment. Such comments included “Not clear what the plan is proposing – against paving the central area” (Local resident, R18) and “No elevations given – need more details to comment” (Local resident, R13). These responses suggest that some respondents felt the presentation provided insufficient information for a proper consideration of the SFD’s proposed site.

These different respondents’ opinions suggest the impact of the content of the campus map. The map drew attention to the green space next to the proposed SFD site, which led to an interest in protecting this space. This result occurred, in part, because the presentation boards used in the exhibition did not communicate detailed information regarding the size and various functions of the SFD building. Had the presentation boards provided this information, more respondents may have agreed with the siting decision. As a result, the University concluded that the public opposed the proposed SFD site, as respondent comments were seen as representative of public opinion as a whole.

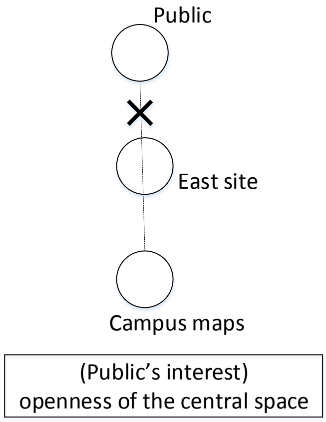


Figure 5-3 Public opposition to the proposed east site

To summarize, many respondents opposed the proposed east site as it was presented in campus map in the exhibition (Figure 5-3). This opposition emerged when the campus map was presented during the public exhibition and was based on an interest in preserving the bright and open character of the existing green space intended as the SFD site. In other words, the way in which the campus map proposals were presented drew particular attention to the green space, which led to respondent opposition to constructing the SFD building on the east site.

5.3 The final decision on the building location

After the public consultation, the architects reconsidered the size and location of the SFD building. Based on the public's interest in preserving the central green space, they first proposed reducing the footprint of the building. The original building area was proposed at 6440m^2 and the height at over 4 storeys, which would shade the green space (Campus Master Plan Development Team report, July 2008). As a result, while this size could comfortably accommodate the additional shared teaching spaces initially deemed necessary, these spaces were eventually considered as beyond the scope of the SFD's requirements.

The architects then considered two options for accommodating this smaller building. The first was to construct it on the east site, which was still considered appropriate because of its central location, and was based on the University's interest in the off-campus visibility of the building. The second option was to locate the building on an existing car park space, a site that was removed from the central green space but still relatively close to the Purbeck Building. Importantly, the architects proposed this option based on the public's desire to preserve the open green space, but not on the University's interest in the building's visibility.

The University's Board of Governance (BG), including the Vice Chancellor, the Deputy Vice Chancellor and the Finance Officer, considered these two options and decided on the car park site. Their decision was based primarily on the Vice Chancellor's strong preference for this site:

> (Why… how did you decide the location of the building?) I don't know, because it was the Vice Chancellor who made that decision.
>
> (Deputy Vice Chancellor interview, April 2013)

> There was no… real enthusiasm amongst the Board of Governance for it to go there… he is the chief executive of the organization, so he is the most senior person here, so not altogether surprising people would listen to what he says.
>
> (Finance Officer interview, July 2013)

These statements suggest the impact of the Vice Chancellor's position in the campus hierarchy as well as the other BG members' seeming lack of interest in the building location. The BG members agreed with the Vice Chancellor's decision[30] without knowing the reason for his preference. Furthermore, the Vice Chancellor apparently did not have to engage or persuade other Board members or articulate his own interests in this decision; rather, he persuaded the other members through his position in the University.

The interviews also suggest that the other BG members did not have much interest in choosing either option, and thus did not necessarily oppose the Vice Chancellor's decision. Significantly, prior to the public exhibition, several Board members, including the Vice Chancellor, chose the east site as

[30] The Vice Chancellor was not interviewed regarding his explanation for this choice because the fact that other BG members followed the Vice Chancellor's lead without knowing his reasoning explained the BG's ultimate decision in locating the building. According to a campus master plan project manager, during the public consultation period the Vice Chancellor discussed this decision with various important personnel, including political figures, which may have influenced his opinion. However, confirmation of this information was unlikely to be gained from an interview.

the building location. However, based on public opposition they changed their position to the car park site.

In March 2008, the FG members learned the SFD building would be located on the car park site. The FG's chairman, the Deputy Vice Chancellor, confirmed the decision regarding the site at the feasibility meeting. Most of the FG members, including the SFD, the HoSM and the Deputy Vice Chancellor, accepted the BG's decision. The SFD representative accepted that this decision was made by the Vice Chancellor as he wanted to preserve the green space (SFD representative interview, April 2013). By contrast, the HoSM and the Deputy Vice Chancellor accepted this decision based on the public's interest in the green space:

> …there was a real nervousness about making that central key green space feel more enclosed.
>
> (HoSM interview, August 2013)

> I would have… probably have favoured putting something slightly more permanent … a slightly more visible building …the difficulty with that one (locating the building at the east site) is… it turns out an open space into some sort of narrow space which… might have proved unpopular with colleagues.
>
> (Deputy Vice Chancellor interview, April 2013)

The above quotes suggest the HoSM's concerns about green space and the Deputy Vice Chancellor's concerns about "colleagues"[31] with respect to their acceptance of the building location decision. In other words, most of the FG members prioritized the public interest and the Vice Chancellor's wishes, and after the public consultation period, they changed their preferences from the east site to the car park site.

However, in spite of this support, the Dean of the Faculty opposed the BG's decision and remained in favour of the east site even after the public exhibition. She was interested in maximizing academic integration between the Schools in her Faculty by locating them adjacent to each other, and, as stated above, the east site was closer to the Purbeck Building than old car park site (SFD

[31] The Deputy Vice Chancellor referred to the respondents who opposed the east site included academic staff as "colleagues".

representative & SFD Head interview, April 2103). In other words, her wishes reflected the University administration's earlier preferences of siting the building to either the east or the west of the Purbeck Building. However, in the end the feasibility group did not choose the east site and overruled the Dean of the Faculty's preferences. Notably, the University's interest in academic integration was incorporated into the University's first proposal, but the same interest was dropped as the public's interest and the Vice Chancellor's preferences became clear.

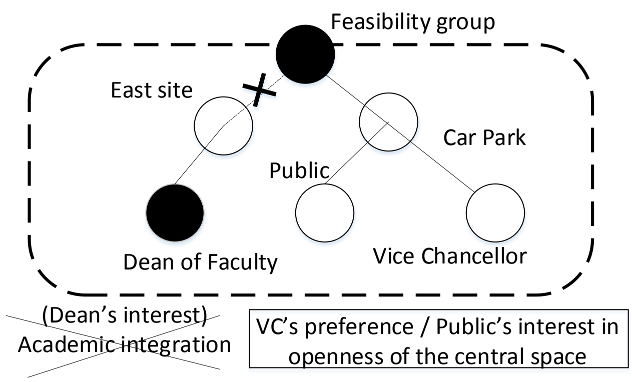


Figure 5-4 Feasibility group's support for the car park site option

To summarise, the FG members chose from two options with respect to the various actors who supported them. The Vice Chancellor and the public supposedly supported the car park decision and the Dean of Faculty favoured the east site option. Ultimately, the FG members chose the car park site by prioritizing the public and Vice Chancellor's preferences over the Dean's interests (Figure 5-4). The Vice Chancellor supported the car park option, and the FG members assumed that the public preferred the car park option to the east site option (represented by solid lines). However, the Dean of the Faculty supported the east site option based on her interest in academic integration (a dotted line). By comparing the actors who supported the two options, the other FG members chose to accept the building location as the car park site over the east site. The Vice Chancellor's preferences and the public's interest in the openness of the green space were incorporated into the decision about the building location. However, the Dean's interest in the academic integration was not taken into account.

Notably, throughout this process the FG members assumed that the public's interest in preserving the green space led to the selection of the car park. However, the public did not participate in the process of choosing between these two options.

5.4 Effects of the building site decision

Additional concerns arose as a result of the building site decision. In February 2008, the question of shared use of the Purbeck Building's facilities arose during a feasibility meeting. The HoSM proposed that the SFD could use the theatre and a teaching space located in the Purbeck Building, which was related to her suggestion of siting the SFD close by. Also in 2008, site preparation discussions, including tree preservation and how to avoid damaging subsurface steam ducts, began after the BG members chose the car park site.

5.4.1 Shared use of the Purbeck facilities

In February 2008, the feasibility group began to discuss potential shared use the Purbeck Building's facilities. Based on her interest in maximising the use of existing resources, the HoSM proposed the shared use of the Purbeck's theatre and teaching spaces (SFD representative & SFD Head interview, April 2013; HoSM interview, August 2013). However, the SFD staff preferred locating their theatre and teaching spaces in the new building.

The SFD representative explained her opposition to the HoSM's shared use proposal in a report, in which she related that the theatre was unsuitable for the SFD's production needs. The report maintained that the Purbeck theatre's stage, particularly its proscenium arch, was unsuitable, as it did not suit the SFD's contemporary theatre performance needs. In addition, the report maintained that the theatre would require new lighting, sound and projection systems, as the present systems were outdated. Also, the SFD was particularly opposed to the theatre's fixed seating configuration, which would limit the arrangement of the audience and equipment, a priority for many productions. The report concluded that while the Purbeck Building's theatre could be potentially used as a workshop space it was unsuitable for performances. In other words, the SFD opposed the HoSM's proposal about the shared use of the Purbeck theatre, based on its interest in maintaining the SFD's theatre performance style. As a result, the HoSM accepted the SFD's position, and agreed to construct a theatre in the new building that would better suit the SFD's performance needs. Thus, the HoSM's wish to share the use of the Purbeck theatres between the SFD and other schools was not fulfilled;

> … we were hoping we were able to combine the two uses [the SFD's and other Schools' use of a theatre space]... a theatre is a theatre isn't it? …apparently not...we were told….you couldn't combine the two uses.
>
> (HoSM interview, August 2013)

However, the HoSM did succeed in persuading the SFD representative to share the Purbeck Building's teaching space. Initially, two options had been discussed: sharing the Purbeck space, and building a new shared teaching space in the SFD building. At the outset, the FG members, particularly the Head of the School of Humanities and the Head of the School of Language, supported the idea of building a new teaching space in the SFD building. However, this option was abandoned when the planned footprint of the SFD building was reduced due after the public consultation period about the campus master plan. Had the footprint of the building remained the same during the decision-making process, the shared teaching space might have been included in the new SFD building design.

Only after the shared teaching space proposal was abandoned did the HoSM propose to share the use of the Purbeck teaching space. She discussed the general availability of teaching space on the main campus with the Central Room Booking staff and concluded that there was sufficient teaching space in the Purbeck building to accommodate the SFD's planned seminars and classes. However, the SFD opposed the HoSM's proposal, raising concerns about how the Purbeck space was equipped. The SFD staff stated that they required classrooms equipped with video and DVD players, as the SFD's seminars and classes often involved the use of images (SFD Head interview, April 2013). In response to this opposition, the HoSM proposed that the teaching space in the Purbeck building could be equipped with video and DVD players to accommodate the SFD's needs (Estates Department report, March 2008). As a result, the HoSM successfully persuaded SFD representative and the SFD Head to agree to use the space in the Purbeck Building, in alignment with the Estates Strategy which aims to maximise the use of existing space;

> …if it's a normal generic class room or seminar room, we try to stipulate, that it would be available to anybody within the University[32]...
>
> (HoSM interview, August 2013)

> The university said …it's Head of Space Management, in charge of space …Her department said that … the university already had… too much physical space per number of students…
>
> (SFD Head interview, April 2013)

The analysis highlights actors' strategies of using persuasion in various facets of their proposals. The SFD cited theatre equipment unsuitable to the SFD's academic activities as sufficient reason to oppose the HoSM's proposal to share the Purbeck theatre. On the other hand, the HoSM used the Central Booking Office's timetables to support her proposal to share the Purbeck teaching space. The HoSM also offered to outfit the space with DVD and video equipment in her proposal, which incorporated both the HoSM's interest in maximising the use of the existing space and the SFD's interest in carrying on its academic activities.

While the SFD preferred having teaching space in the new building during the project, either the SFD representative or the SFD Head did not strongly insist on it. However, the SFD's interest in the teaching space in the new building more clearly emerged after the building project completed. The SFD representative and the SFD Head regretted not including teaching space in the building once they started using the building. The SFD Head stated that the SFD staff were interested in equipment

[32] Interestingly, the HoSM did not remember that the discussion resulted in the shared use of the Prubeck teaching space. Instead, she recalled that the new teaching space in the SFD building was decided to be shared across Schools. This implies that a choice from these two options was iteratively considered throughout the feasibility meetings.

operability without facing unexpected troubles[33] with playing videos and DVDs. Also, the SFD representative became more concerned with visitors' impressions of the SFD, who, according to the SFD representative, tended to perceive that the SFD "only teaches practical work", as the new SFD building did not include teaching space;

> To be honest, I didn't mind if we didn't have seminar rooms here…. I might think differently now…. Would I change anything in retrospect?... Well, I would change one thing… I think it's interesting that we are owning the spaces that only are specialist spaces. But I think it does kind of signal certain things about our department, which aren't necessarily true. People look at us as practical only department cause they can't see the seminar spaces here… (So if it's possible, you want to include…?) I would have done… if it had been possible, but that would be greedy.
>
> (SFD representative interview, April 2013)

5.4.2 Site preparation: Tree assessment and protection

The SFD building site preparation process was first discussed during the development of the campus master plan in 2007, and specific meetings regarding this work began when the SFD building project team members became involved in July 2008. The decision about the location of the building had a certain impact on the site preparation including an issue of tree protection and that of avoiding subterranean steam ducts.

Early on, the University's Estates Department raised the issue of onsite tree preservation based on the University's interest in maintaining its reputation for protecting trees:

> We have 7,000 trees on this campus. When you've got that many, and lots of them are special… if you kill that, you're in a lot of trouble, so we take a lot of care of protecting our trees… from... the outside looks really bizarre, but actually it's a real challenge for the construction team … because we're so proud of our campus, it's one of our key selling points…
>
> (HoSM interview, August 2013)

In addition, the local authority requires tree preservation, a fact that could have affected obtaining planning permission of the building project (HoSM interview, August 2013). Local authority officials

[33] The SFD Head mentioned his experience of losing a remote controller, or finding a controller without batteries.

are authorized to place protection orders on rare or very old trees, including those on the University campus, prohibiting any construction work around those trees. As a result, the Estates Department employed tree specialists so the University could carry out construction work without regulatory intervention.

In June 2008, the Assistant Grounds Manager, who was one of the Estates Department's tree specialists, surveyed the trees on the SFD site to classify them and specify zones necessary for root protection. During this survey, the Manager recorded eleven young and 26 mid-aged trees on or near the proposed site. Of these trees, six were classified as 'A' grade, which meant their preservation was required. The remaining trees were deemed of moderate or low value (Architects June 2009). In addition, the manager proposed setting root protection areas around the six A grade trees to safeguard them during construction (Assistant Grounds Manager report, November 2009).

Based on the Manager's survey, the architects revised the building footprint to avoid the A-graded trees and root protection zones. However, the architects deemed the loss of a few non A-graded trees as inevitable, and proposed that 17 moderate and low value trees be removed (Architects report, June 2009). They considered this plan as a compromise to accommodate the footprint of the SFD building while retaining the high-value trees.

This analysis highlights the interdependence between the tree specialist's proposal and the architects' proposal. First, based on the Department's interest in maintaining the University's reputation for tree preservation and the local authority's requirements, the Estates Department raised the tree protection issue and involved one of the tree specialists. Second, the tree specialist specified protection areas and the retention of specific trees on the site. Finally, the architects modified the SFD's building footprint according to these new specifications. In sum, the architects' proposal to change the building footprint was contingent upon the tree specialists' evaluation, which in turn, arose from the Estates Department's decision to employ tree specialists. The architects' proposals incorporated both the Estates Department's interests and the local authority's requirements as well as the SFD planning requirements for the building footprint size.

5.4.3 Site preparation: Steam ducts

The architects proposed placing the building along the main University steam duct. This issue of avoiding steam ducts would not have emerged if the building had been built on the east site;

> … the only abnormal thing in SFD, was they built it… very close to the steam main duct, ok?... if you build it right in the middle there [the central green space]… There would be no problem whatsoever, it's just grass …But... because the University… wanted it over there… it meant... you get a series of cascade in decisions.
>
> (Services engineer interview, March 2013)

The architects' proposal of the building footprint resulted in several challenges. First, part of the proposed building footprint covered an expansion loop, or an arm of a steam duct system designed to absorb steam expansion, that the Estates Department planned to replace in the near future. Thus, the Department questioned how to construct the building over this loop while still allowing for its future replacement. In response, the structural engineers proposed constructing a chamber around the expansion loop capped by a slab that could later be broken to allow for its removal and replacement.

In addition, the engineers stated that site activities, particularly the movement of heavy vehicles, could lead to the fracture of the steam ducts, potentially affecting the entire University's heating system (Service engineer interview, May 2013). In response, based on concrete reinforcement calculations and the contractors' estimations of live vehicle loads, the engineers proposed reinforcing the surfaces under the vehicle routes that would cross the ducts.

As above, this analysis also underscores the interdependence and interplay between different actors' proposals. First, the architects proposed to design part of the building footprint over the subsurface steam expansion loop. The University administration responded by raising concerns regarding the future replacement of the expansion loop. Then, to address these concerns, the structural engineers proposed constructing a slab over the loop. Finally, the project team raised an issue of potential duct fracture during site preparation, and the structural engineers proposed reinforcing the surface and specific vehicle routes to address this issue. In sum, the Department and the project team members' concerns emerged based on the architect's proposed building footprint, and the structural engineers' proposed solutions incorporated both the Department's and the project team members' interests. In contrast to the previous issue of tree protection, not only the Department's interest but also the project team members' interest emerged and was incorporated into the proposed solutions for the issue of steam duct.

5.5 The incorporation of actor interests into the building location decision

With respect to siting the building, some, but not all, of the actors' interests were incorporated in the decision-making processes. The concerns surrounding the building location included 1) choice of the building site (Sections 5.1-5.3), 2) shared use of the Purbeck facilities (Section 5.4.1) and 3) the site preparation work required (Sections 5.4.2, 5.4.3).

Table 5-2 shows the actors' interests that were incorporated (IN) and those that were not incorporated (NIN) into the proposed solution at various points in this process. The term *actor interest* includes those interests that were ascribed by other actors in their proposed solutions. For example, the public's interest was seen by some to be factored into the architects' proposal of the car park space, although the public neither proposed nor chose this option.

Table 5-2 Incorporation of actor interests into the proposals about building location

	Proposed solutions	Actors	Incorporation of actors' interests
5.1	Recommendation of the east site over the west	HoSM, architects	**IN:** (HoSM) Academic integration (architects) Reinforcing the centre of the campus, Avoiding visual competition (Uni) Drawing visitors into the centre of the campus **NIN:** (Uni) Making the building visible from the outside the campus
5.2	Public opposition to the east site	The public, the campus map	
5.3	Selection of car park site	Architects, Vice Chancellor, FG members, Dean of the Faculty	**IN:** (public) Maintaining the openness of the green space, (BG, FG) Following the Vice Chancellor's preferences **NIN:** (Dean) Academic integration
5.4.1	HoSM and SFD's discussion of sharing Pubeck teaching space and new SFD theatre construction	The SFD, the HoSM	**IN:** (HoSM) Maximising the use of existing teaching space (SFD) Maintaining schools' theatre performance style **NIN:** (HoSM) Maximising use of existing theatre (SFD) Flexibility of teaching space
5.4.2	Protecting onsite trees	Estates Department, Grounds Manager, architects	**IN:** (Estates) Satisfying local authority (Uni) Maintaining campus trees to maintain reputation
5.4.3	Constructing slab over expansion loop /strengthening ground	Estates Department, structural engineers	**IN:** (Uni) Easy future removal of subsurface steam duct (project team) Minimising risk of steam duct fracture

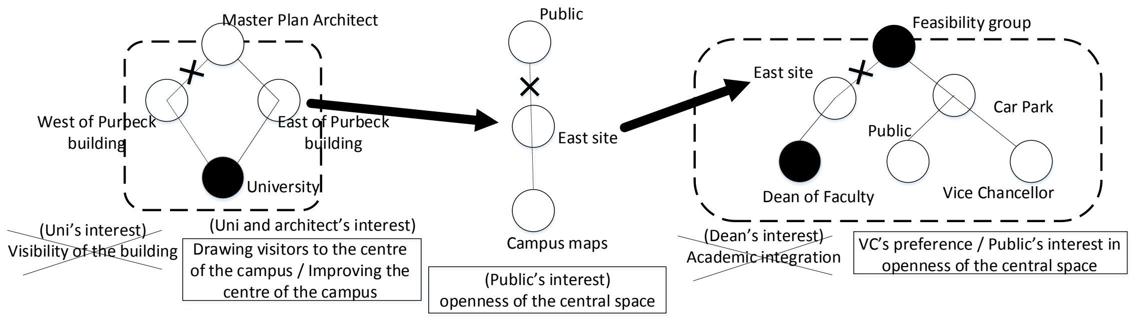


Figure 5-5 Actors' problematization of the options surrounding building location selection

The process by which some actors' interests were incorporated over others varied for each issue. Regarding the building site selection (5.1-5.3), various clients (i.e. University members) favoured different options at each moment such that some client interests were prioritized over others. By contrast, regarding the decision about the shared use of the Purbeck facilities (5.4.1), different client members, the SFD and the HoSM, persuaded each other to support one option, incorporating both of client interests. In terms of the site preparation decisions (5.4.2, 5.4.3), project team members proposed solutions for interdependent issues, successively incorporating both clients' and project team members' interests.

Among all of the challenges related to locating the building (5.1-5.4), the selection process (5.1-5.3) involved a number of clients and their interests at different points, which often complicated the process of incorporating client interests. Figure 5-5 shows the change in different actors' preferred options for the building location. The master plan architect first proposed the east site, whereas the public opposed this option. After that, the Vice Chancellor strongly preferred the car park space. To align themselves with the Vice Chancellor's wishes and assumed public wishes, many University members moved in support of the car park site. The analysis highlights the range of actor interests which influenced the choice of the building location, including those ascribed to other actors. Notably, the ascribed actor interests (e.g. the master plan architect's specification of client interests, the feasibility group's ascription of the public interests) influenced the choice of the building location at different times. The range of actor interests and their preferred options travelled across actors' successive problematizaions and were compared with each other, which resulted in the final decision of the building location.

In order to make a final decision, the clients (i.e. the University) made alliances with each other with respect to their preferred options. Viewed as a whole, the University members' interests and choices were divided: most of the University members supported the car park space based on alleged public support and the Vice Chancellor's preferences, whereas the Dean of the Faculty supported the east option based on her interest in enhancing academic integration. As a final decision was made that the building would be located at the car park site, both the Dean's and the University members' initial support for academic integration and the University's initial interest in drawing visitors into the campus centre were dropped. This analysis highlights the way some client interests were incorporated over others through clients' alliances in decision-making processes.

Aside from the clients, other actors, including the architects, the campus master plan and the public were engaged in the decision-making process. For example, the architects proposed options for the building location and were able to bring various actors' interests into alignment with these proposals including their own interests (e.g. the recommendation of the east site). However, although the architects were able to propose solutions based on their interests, these solutions were the subject of the client's selection. Thus, the clients had more power to impose their interests overruling the architects' interests (i.e. the final rejection of the east site). Also, the campus map influenced the emergence of public opposition to these preferences, and as a result, the public had an impact on the clients' final decision. However, public opposition to the proposed site option was, again, subject to the clients' priorities. Significantly, it was not the public preference that influenced the University administration's final decision, as the public did not choose the car park space over the east site. In this chapter, clients' decision-making process about the building location was analysed which was under the influence of a range of actor interests and preferences.

6 Space allocation

The School of Film and Drama (SFD) and the architects were the main actors involved in allocating the spaces for the new building. The term *space allocation* refers to determining the area and location of architectural spaces within a building footprint and the relationships between these spaces. At the beginning of the allocation process, the SFD[34] and the architects developed the project brief. Throughout this process, the SFD and the architects discussed the area, location and adjacency of various functional spaces with respect to the building footprint. However, this allocation was later changed in response to a reduction in the project budget. Thereafter, additional questions arose during the detailed design stage based on decisions made at the concept design stage. Table 6-1 lists an abbreviated timeline for this process and the key actors involved.

Table 6-1 Timeline of key moments of decision-making processes about the space allocation

	Decision-making process	Actors	Date
6.1	Development of briefing documents	SFD, project manager (PM), architects	Feb - Jul 2008
6.2	Area, location and adjacency of functional spaces	SFD, architects	Jun 2008-Mar 2009
6.3	Changes in space allocation following budget reduction	SFD, architects, University administration	Sep 2008-Mar 2009
6.4	Issues arising at the detailed design stage as a result of the concept design decisions	PM, SFD, acoustician, structural engineers, architects, contractor, supplier	Mar 2008-Oct 2009

This chapter discusses the effect of interdependencies between decisions on the incorporation of client interests. More specifically, it shows how various space allocation proposals became interdependent with respect to the area, location and function of spaces, and how this interdependence led to the incorporation of the SFD's interests into solutions that addressed some spaces, but not others.

[34] The SFD members did not encounter major disagreements during this process (SFD representative, SFD Head interview, April 2013; architects interview, June 2013). As a result, for the purpose of this research the SFD representative's interests are presented as a proxy for the SFD's interests as a whole.

6.1 Briefing document development

The project briefing process produced a series of documents: an initial brief, a final brief, a space need indicator framework and a concept design sketch. Various actor interests were incorporated into the development of these documents.

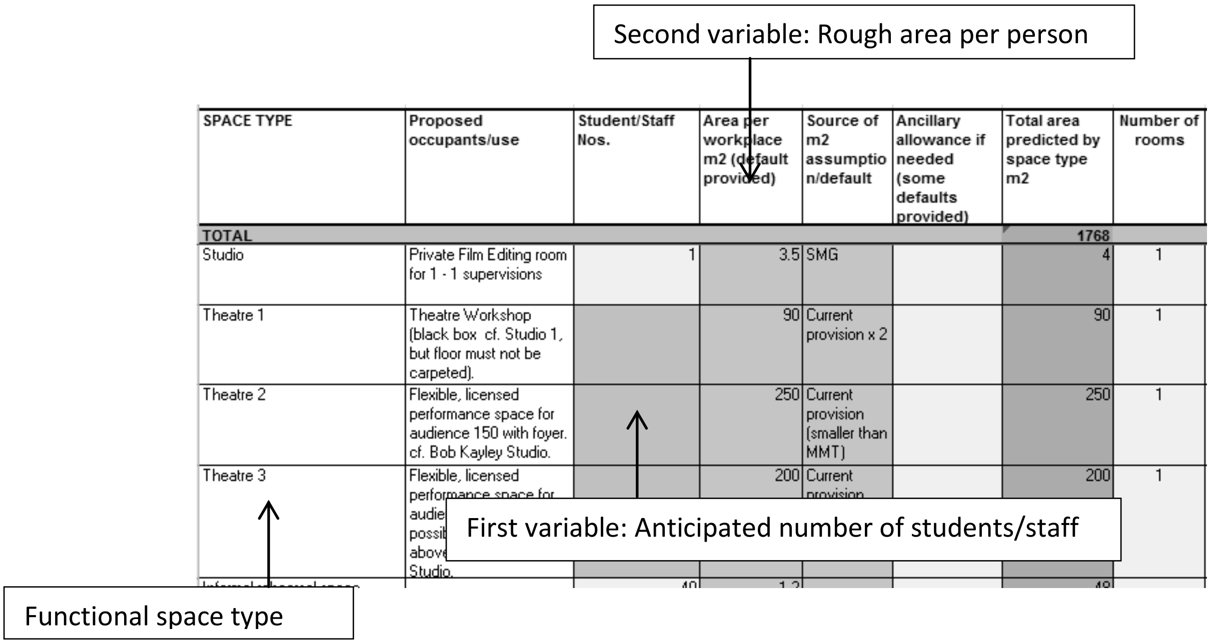
During meetings held between July 2007 and February 2008, the project feasibility group (FG) asked the SFD to produce a project brief. In this brief, the SFD representative listed the functional space types required for the new building, including performance spaces (i.e. three theatres of various sizes), a screening room and a TV studio. The SFD also wanted areas to support the performance spaces, including storage rooms, a workshop for theatrical sets and costumes, and dressing areas.

In June 2008, SFD members, architects and the PM discussed the initial project brief. The architects proposed to expand the initial requirements to include an additional informal rehearsal space. In response, the SFD accepted the architects' proposal:

> We said... right at the beginning, we need space... that's where people will feel comfortable, they can relax and they can do things.
>
> (Lead architect interview, June 2013)
>
> They always said we wanted something, we wanted space where… yes with specialist space, but people also could work, outside of those spaces, in… just in corners, really, which we've got.
>
> (SFD representative interview, April 2013).

The architects based their proposal on the interest in creating spaces for interaction, and the SFD accepted the inclusion of an informal rehearsal space based on its interest in additional performance spaces. As a result, the final brief included an informal rehearsal space within its list of required functional spaces.

After the final brief was developed, to determine the approximate area of each functional space, an external PM produced a space need indicator framework (External PM spreadsheet, July 2008). This spreadsheet, presented below in Figure 6-1, lists functional space types (the leftmost column), the anticipated number of students and staff that would use each space (the first variable), and the workspace area per person (m^2) (the second variable) (Figure 6-1). The rough area of each functional space was calculated as the product of the first and second variables.



SPACE TYPE	Proposed occupants/use	Student/Staff Nos.	Area per workplace m2 (default provided)	Source of m2 assumption/default	Ancillary allowance if needed (some defaults provided)	Total area predicted by space type m2	Number of rooms
TOTAL						1768	
Studio	Private Film Editing room for 1 - 1 supervisions	1	3.5	SMG		4	1
Theatre 1	Theatre Workshop (black box cf. Studio 1, but floor must not be carpeted).		90	Current provision x 2		90	1
Theatre 2	Flexible, licensed performance space for audience 150 with foyer. cf. Bob Kayley Studio.		250	Current provision (smaller than MMT)		250	1
Theatre 3	Flexible, licensed performance space for audie[illegible] possi[illegible] above[illegible] Studio.		200	Current provision[illegible]		200	1
[illegible]		40	1.2			48	

Figure 6-1 Space need indicator framework spreadsheet[35]

The list of functional space types was based on the final project brief. The first variable (anticipated student and staff users) was calculated based on the SFD's interests in accommodating the School's activities. The second variable (workspace area per person [m^2]), was determined based on three values: the workspace area afforded the SFD's existing facilities, the workspace area suggested by the HEFCE's (Higher Education Funding Council for England) Space Management Group (SMG), and the University's official requirements for workspace area. The first value was used to determine average workspace per person, particularly for the SFD's specialized facilities, such as performance spaces, and was based on the University's interest in preventing the creation of unnecessary extra spaces. As the March 2008 business case[36] noted, "it is assumed that current provision is neither over- nor under-provided" (Estates Department March 2008). The second and third values were

[35] This figure represents the section of the spreadsheet, to which the author added explanations of each column.
[36] The business case was produced to set the project's goals, scope, benefits and risks, and required the approval of the Board of Governance before the concept design stage could proceed.

used to calculate the areas of standard teaching and office spaces[37]. These values were based on the University's interest in both keeping the School's workspace allocation on par with other institutions and minimising any unnecessary space. Throughout this calculation process, all three values were used to reflect the University's interests with respect to the area of functional spaces.

To develop the design concept based on the brief, the architects produced an initial rough concept sketch of the building based on the list of functional spaces presented in the brief and the approximate area of these spaces. The architects proposed a concept in which the four large performance spaces – Theatre2, Theatre3, a screening room and a TV studio – were housed at the four corners of the building and surrounded a central atrium (Figure 6-2). One major element of the design was based on the architects' desire to create a welcoming entrance hall. According to the architects, a large "obvious entrance" was necessary to "draw people" into the building (Lead architect interview, June 2008). The SFD Head also supported the design of this entrance hall, describing it as a "friendly" and "welcoming" space (SFD Head interview, April 2013).

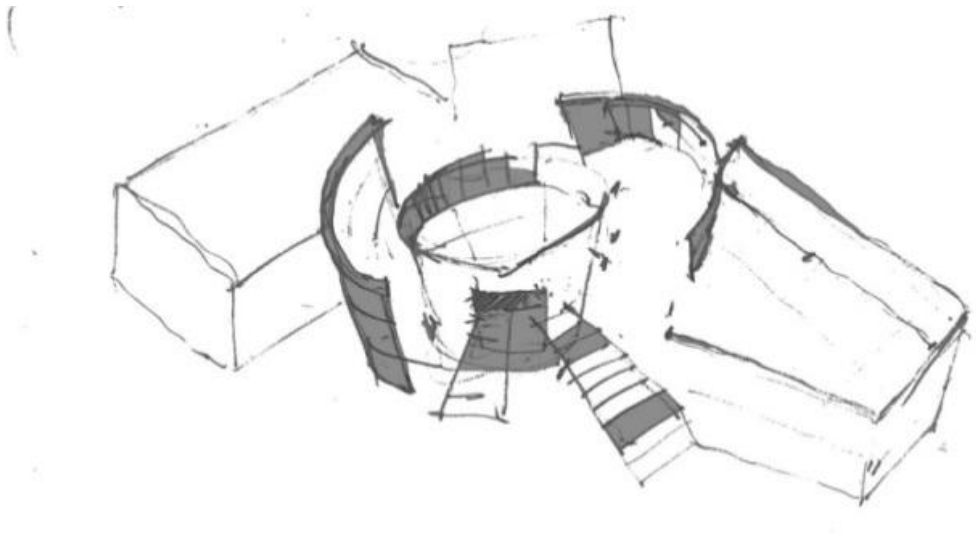


Figure 6-2 Architects' concept design sketch

[37] At this time, the spreadsheet also included seminar rooms and classrooms, which were later eliminated from the design. The SFD instead elected to use the Purbeck Building's teaching spaces. See Chapter 5, Section 5.4.1 for this analysis.

The discussion above describes how a series of briefing documents were developed to reflect a number of client interests as well as the architects' interests. First, in the original project brief, the SFD stipulated its requirements based on its interests in accommodating the SFD's academic activities. However, the brief changed based on the architects' desire to create areas for informal interaction and the SFD's interest in adding an extra performance space to the design. Second, the approximate areas of required spaces were calculated using both current and standard provisions set by HEFCE and University regulations. Thus, the University's interests in avoiding the excessive provision of space and minimising unnecessary areas were incorporated. Finally, the architects proposed their design concept, partly based on their interest in drawing people into the building.

6.2 The area and location of functional spaces

After the final brief was completed, SFD members (i.e. SFD representative, SFD Head, technicians and other staff, and select students) and the architects held a series of meetings to discuss the area of various functional spaces, prioritize these spaces, and allocate them within the building footprint.

6.2.1 Size of storage spaces and dressing rooms

In July 2008, the architects presented their initial concept plan. One of the SFD's requirements in the original brief was to locate storage spaces adjacent to theatres. This requirement was based on the SFD's interest in easy movement of equipment and sets between storage areas and the theatres. Based on this requirement, the architects designed a small storage space (as well as male and female dressing rooms) adjacent to each of three theatres. Figure 6-3 presents a detail of this initial plan showing the area and location of the proposed storage spaces and dressing rooms. It is important to note that the dressing rooms were designed to be larger than the storage spaces.

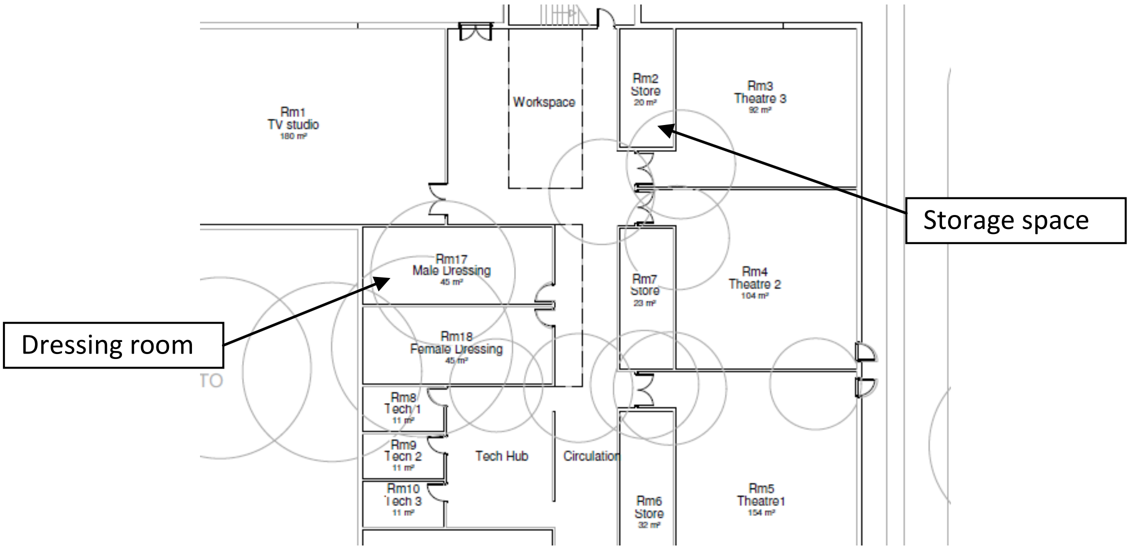


Figure 6-3 Plan detail showing the area and location of storage spaces and dressing rooms[38]

In response to this plan, the SFD proposed to increase the area of the storage spaces (SFD representative report, July 2008). The SFD wanted to house large set pieces and equipment in these areas, including costumes, furniture, seats and rostra. Also, to accommodate material such as scenery flats, ladders, and scaffold towers, some storage spaces required ceilings higher than a single storey. This was a concern for SFD members, as their existing facilities housed a large storage space.

Along with increasing the storage area, the SFD wanted to decrease the size of the dressing rooms, as the architects' sketch indicated the maximum size of the building footprint. In the architect's email to which the initial sketch was attached, the architect raised awareness that the building avoided trees, steam ducts and electrical cables, implying that the building footprint was outlined in the sketch in a maximum size on the chosen site. Based on the understanding of the limited size of the building footprint, there was no need to separate dressing rooms by gender from the SFD's perspective, and large combined dressing rooms would occupy less space. The SFD maintained that students could also make costume changes behind the theatre curtains. The architects found this response unexpected, because they had previously designed dressing rooms for professional

[38] The figure represents the section of the architectural floor plan, to which the author added the name of the rooms.

theatres, for which certain spaces are required (Architects interview, June 2013). This request made the architects realize that the SFD required performance spaces primarily for teaching purposes, not professional ones.

To summarise, the architects' initial design caused the SFD to prioritize storage areas over dressing rooms. This is because the plan, for the first time, presented the relative size of these two spaces, which had not been clarified in the space need indicator framework, which presented the area of each space in numerical figures. In addition, the design presented the maximum area of the building footprint; thus, the SFD understood that any increase in storage area required a decrease in the size of another space.

6.2.2 Height and location of Theatre 1

After a series of workshops regarding spatial allocation, the architects raised the issue of accommodating all of the required functional spaces within the building footprint. In particular, the architects considered that the size of the large, two-storey performance spaces limited the inclusion of other spaces in the building. To address this concern, in September 2008, the architects proposed to amend the height of Theatre 1 from double to single-storey. In addition, after the project budget was reduced in November 2008, they proposed relocating this theatre to the first floor.

In reference to this change in the height and location of Theatre 1, the lead architect explained;

> … we put the third theatre upon to the first floor. It was originally on the ground floor, but that put so much pressure on the ground floor… we didn't have enough ground floor [area] to make that open.
>
> (Lead architect interview, June 2013)

This statement suggests the architects' desire to keep the ground floor space open, which they felt would be more effective and pleasing[39] (Architects interview, June 2013).

[39] The architects did not directly indicate their interest in a pleasant space with respect to their proposal for Theatre 1. However, they implied these interests through their proposals of making other spaces open, such as

The SFD representative was reluctant to accept the architects' proposal for a number of reasons. First, a lower theatre height would reduce the lighting aesthetics (SFD representative interview, April 2013). Second, the representative was concerned that the heat from lower ceiling lights might adversely affect performers, causing discomfort (Design team meeting minutes, November 2009[40]). However, despite these disadvantages, in the end the SFD agreed to change the height of Theatre 1. The SFD representative later said of this compromise:

> ...it is very low for a theatre, and therefore, in some ways, not ideal. On the other hand, I thought we would lose that space altogether at some point… so I was always pleased to keep hold of it.
>
> (SFD representative interview, April 2013)

This statement suggests that the SFD's acceptance of the reduced height of Theatre 1 was based on its interest in retaining all three theatres in the plan. Presentation of the floor plans facilitated the SFD's understanding that the building footprint restrictions limited the accommodation of all of the required functional spaces. Furthermore, the SFD representative did not offer an alternate proposal to accommodate the three theatres, such as eliminating other functional spaces, because they relied on the architects' skills to accommodate the spaces within the building footprint.

To summarise, in response to the architects' proposal, the SFD compromised on the dimensions of Theatre 1. Figure 6-4 illustrates the proposal of a single-storey height for Theatre 1 (represented by the solid line) over a double-storey height (crossed dotted lines). As stated above, the SFD originally preferred a double-storey height of Theatre 1 (a dotted line in the middle), but the SFD accepted the reduced height in order to retain all three theatres within the constraints of the building footprint (solid lines within the smaller rectangle). Thus, the architects' interests in making the ground floor more open and the SFD's interest in accommodating all three theatres were incorporated into the

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the atrium and the office space. This analysis assumes that this interest can also be applied to the architects' proposal about Theatre 1.

[40] The SFD raised this concern of lighting heat to performers a year after the architects proposed to change the height of Theatre 1. This implies that the SFD continued to raise concerns about the single-height of Theatre 1 throughout the concept stage.

final decision. However, the SFD's interests in lighting aesthetics and in minimising lighting heat concerns were not.

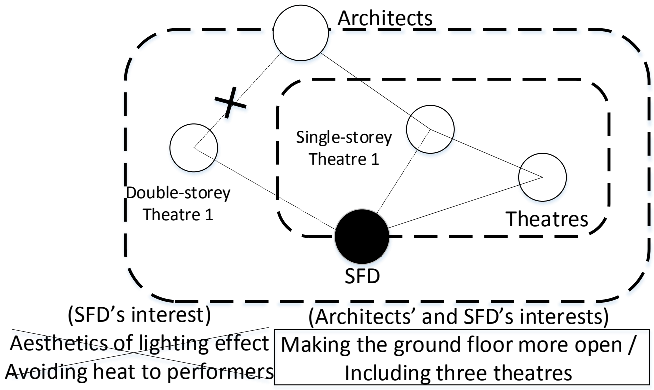

Figure 6-4 Architects' problematization of a single-storey Theatre 1

6.2.3 The adjacency between storage spaces and Theatres 2 and 3

During the space allocation process, to test various spatial configurations within the building footprint the architects used cards scaled to represent the area of each functional space (Figure 6-5).

Figure 6-5 Examples of various spatial configurations using scaled cards (from the architects' presentation slides)

This use of cards was effective in facilitating the SFD's understanding about the limitations of available space and in convincing the SFD of the benefits of the architects' proposed spatial configuration. During this process, the idea of creating a shared storage space between Theatre 2 and 3 emerged[41] (Lead architect interview, June 2013).

A number of the SFD's interests were incorporated into the proposal to create a shared storage space between Theatres 2 and 3. First, the proposed storage space would accommodate large theatre props and equipment, including seating and rostra. Second, this "shared" storage space would enable the SFD to more easily change sets for the two theatres, in effect creating two "flexible" theatres, as equipment could be moved easily to and from the storage space. Furthermore, such a space could be used for various additional purposes, such as conferences, theatre performances and filming. In the end, the SFD recognized that this flexibility would allow the School to hold concurrent performances in one theatre and rehearsals in another. The SFD representative knew that both theatres would be used simultaneously during the students' final performance period, when at least 28 performances are typically held in one week (SFD representative interview, April 2013). According to the PM, this idea of a shared storage space emerged both in discussions with SFD representatives, who had experience with their existing facilities, and the architects, who had experience in designing spatial configurations similar to the SFD's requirements:

> … [the SFD] had the luxury of knowing how they're operated after all the time at the existing facilities…but then, the architect would help them …what happens if you need to get from there to there? … So it's… a partnership, but it not just any one person saying…
>
> (Internal PM interview, April 2013)

However, in response to the incorporation of the SFD's interests into the location of Theatres 2 and 3, their requirements with respect to Theatre 1 were altered. Because Theatre 1 was originally located between Theatre 2 and 3, the addition of a storage space between Theatres 2 and 3 hinged on the relocation of Theatre 1 from the ground floor to the first floor. Thus, the relocation of Theatre 1 to the first floor required the SFD group to compromise. During this discussion, the SFD representative pointed out that this configuration wouldn't allow heavy set pieces to be transported to Theatre 1 (Design team meeting minutes, December 2008). However, in February 2009 the SFD

[41] Locating a storage area between two theatres was presented in the December 2007 floor plan.

representative agreed that they would accept the revised location of Theatre 1, and the SFD and the architects agreed to add a smaller storage space for Theatre 1 on the first floor. As a result of this relocation, the SFD's interest in easy manoeuvrability of props from storage spaces to theatres was moderated, with respect to Theatre 1. Notably, these same interests were incorporated with respect to Theatre 2 and 3 through the addition of the shared storage space between the theatres.

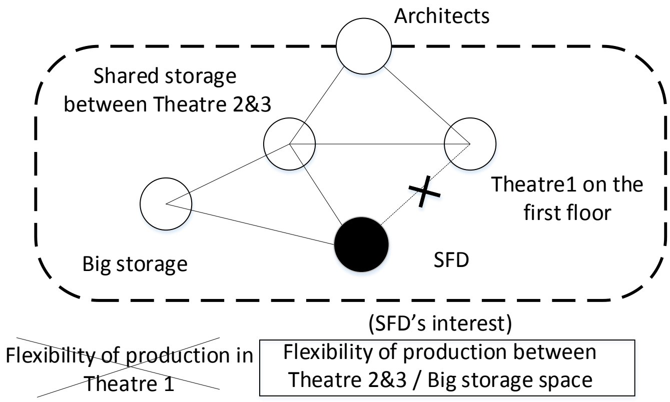

Figure 6-6 Architects' problematization of the shared theatre storage space

To summarise, the architects proposed an additional shared storage space between Theatre 2 and 3, displacing Theatre 1 and necessitating the relocation of Theatre 1 to the first floor (Figure 6-6). Although the SFD preferred locating Theatre 1 being on the ground floor (represented by a dotted line), the SFD accepted the proposed location of Theatre 1. This is because the SFD preferred the location of the shared storage space between Theatre 2 and 3, as well as the area of the storage space (solid lines). As a result, the SFD's interests in transporting large set pieces and production flexibility for Theatre 2 and 3 were incorporated. However, the SFD's interest in easy movement of props to Theatre 1 was not incorporated.

6.2.4 Window placement

The SFD representative and the architects attempted to persuade each other with respect to the placement of the building's windows. The SFD specified large, double-storey performance spaces, and insisted that these spaces did not require windows. This requirement originated from the SFD members' experience with their existing facilities, in which windows in the performance spaces made it difficult to darken these spaces. Also, the SFD wanted to minimize the opportunity for passerbys outside the building to observe students during their rehearsals and performances, as this might be unpleasant for them. In contrast, the architects repeatedly proposed including windows in the performance spaces, based on their interest in enlivening the austere character of the building's exterior. As the proposed performance spaces were so large, and two of them were double-storied, the walls of those performance spaces would comprise most of the building exterior, which would be largely devoid of windows.

While the discussion regarding windows was inconclusive, the architects came up with an alternative that incorporated the interests of the SFD. The SFD required easy access by performers to theatre control rooms. While the architects were initially concerned about the extra cost of this access, which would mean designing corridors in addition to the building's main stairwells, they were inspired to combine this requirement with their desire to enliven the building's facade. The architects proposed an individual spiral stairwell attached to each performance space that could incorporate a window. As a result, the architects' interest in easing the austerity of the building facade and the SFD's requirement of easy access between performance spaces and control rooms led them to propose these windows.

In addition, the architects' aesthetic interests were incorporated into this proposal. In a March report, the architects explained that adding windows to the proposed stairwells would ease the monotony of the present building facade. These windows were specified to be as tall and narrow due to the height and width of the spiral stairwells. Furthermore, this design change would afford "deep views into the building envelope" and "counteract the large areas of block work" (Architects report March 2009). These statements suggest the architects' skill in incorporating their interests despite the SFD's initial objections to placing windows in the building.

However, after agreeing to include windows in the new staircases, the SFD representative revisited the issue by proposing to eliminate the walls separating performance spaces and these staircases. This proposal was based on the SFD's desire for quick access between performance spaces and control rooms. However, the removal of these walls would also require eliminating the staircase windows, because they would allow light into performance spaces. As a result, the suggestion to remove these walls was abandoned (Design team meeting minutes, April 2009). Thus, the SFD respected the architects' interests and compromised, saying "[the window discussion] isn't a big issue for us". The discussion of modulating building facade arose throughout the concept design stage, as new interests for the architects and the SFD representatives emerged.

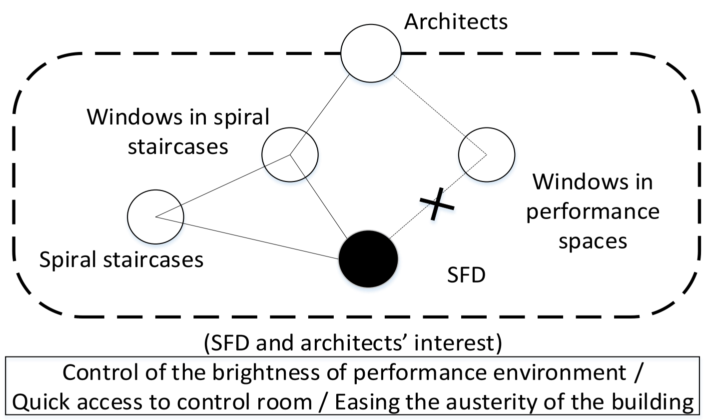

Figure 6-7 Architects' problematization of adding windows to stairwells

To summarise, both the SFD representatives' and architects' interests were incorporated into the proposal to incorporate stairwells with windows into the design. Figure 6-7 illustrates how the architects suggested adding these windows to new stairwells, as opposed to performance spaces. As stated previously, the architects initially proposed including windows for the performance spaces, but the SFD rejected this proposal (dotted line). Thereafter, the architects proposed stairwells with windows based on the SFD's requirement for easy access between performance spaces and control rooms (represented by the solid lines). As a result, this compromise incorporated the SFD's interests in eliminating light from performance spaces and quick access and the architects' interest in easing the austerity of the building facade.

Notably, the SFD's interests were incorporated differently during the discussions of the above spaces: 1) the area of storage spaces and dressing rooms, 2) the height and location of Theatre 1, 3) the shared storage spaces between Theatres 2 and 3, and 4) the inclusion of stairwell windows. In the first case, the architects' concept design prompted the SFD to increase the square footage of storage spaces and reduce the area of dressing rooms. In the second case, the architects drove the SFD's compromise on the height of Theatre 1, which resulted in the attenuation of its own interests. In the third case, the architects suggested shared storage space between Theatres 2 and 3, which resulted in the incorporation of the SFD's interest in Theatre 2 and 3, while the incorporation of the SFD's interest in Theatre 1 was moderated. Finally, in the fourth case, the architects proposed new stairwells with windows by combining two distinct SFD interests, as well as their own interests in modulating the building façade design.

6.3 Changes in the concept design following a budget reduction

In addition to the SFD's requirements, the space allocation discussion described above involved the concerns of University administrators. Significantly, the University's Board of Governance (BG) reduced the project budget in the middle of the concept design phase. As a result, the architects and the SFD revised their spatial allocation strategy to accommodate this new budget. In addition, at the conclusion of the concept design stage, senior administrators proposed changing the entrance to the building. These administrative decisions led to significant design changes.

6.3.1 Budget decisions

From June to September 2008, the architects and SFD members developed a spatial allocation strategy that would reflect project requirements. However, the quantity surveyors involved with the project estimated that accommodating all of the SFD's requirements would cost £13.2m, which was more than double the original project budget of £6.39m. This original budget was estimated in 2007 when the University developed its campus master plan. At that time, the SFD building was one of the future University projects slated for construction over the next 10 years, the total budget for which was set at £250 million.

As the planned SFD building was estimated to far exceed its original budget, the architects proposed five distinct design options with costs ranging from the original budget figure to one that met all the SFD's requirements. The architects presented diagrams to illustrate the differences between the types of buildings the SFD could anticipate for each budget. These diagrams included the building's functional spaces, their rough areas and their location within the building footprint.

The internal PM discussed each of these options in his report in September 2008[42]. In the report, the PM presented each of the five budget options, labelled Options A-E. Option A reflected the highest budget, and met all the SFD's functional space requirements, whereas Option E was the least expensive option that fell within the original budget constraints. The PM reported that Option C, which would cost an estimated £9.84m, was "a minimal scheme which the team felt would enable SFD to continue to operate, but without providing everything in the new building" (Project Manager report, September 2008). For example, the desired screening space and office areas were not included in this option, which assumed that the SDF would use similar spaces in other buildings. He also reported that Option B, the budget for which was £11.93m, was a "sensible compromise between options A and C." For Options D and E, the PM explained that "one theatre and major area of support space or two theatres were reduced from the brief" (Project Manager report, September 2008). The PM stated that these final two options did not include facilities that would allow the SFD to continue to operate its academic activities. Finally, he stated:

> Early indications are that the scheme will exceed the original budget allocation of £6.39M. Various options to omit/reduce spaces have being explored however even the "de minimis" scheme appears unaffordable and as such the project team is seeking guidance on which option to take forward to efficiently conclude Stage 1/Concept Design.
>
> (Project Manager report, September 2008)

[42] The PM regularly produced reports during the concept design stage to document progress for the BG members.

This statement suggests the PM's recommendation to increase the project budget, as he advised the BG members that Options C, D, E were below a "de minimis" scheme. In the end, the PM recommended Option B, describing it as "sensible compromise" based on his assumption that the University would be interested in less expensive alternatives.

In November 2008, the BG members (including the Deputy Vice Chancellor and the Financial Officer) elected to increase the project budget to £11.4m, a sum slightly less than option B.

For his part, the Financial Officer was interested only in balancing the overall budget for all future projects;

> … so [the other BG members] would have determined the priority order,… I would have checked they didn't cost more than £200 million[43], and it would be enough.
>
> (Financial Officer interview, July 2013)

This statement suggests that the Financial Officer's responsibility was to ensure that the total cost of all capital projects would not exceed the allotted budget. He allowed other senior administrators, including the Deputy Vice Chancellor and Estates Department senior personnel, to decide on the prioritization of future projects. As a result, the Financial Officer accepted the SFD building budget increase, while assuming that the budgets for the following projects would be reduced. At the time of the interview with the Financial Officer in July 2013, a café project shown in the campus master plan had been scuttled. In other words, the University's interest in implementing all future projects was attenuated as a result of the increased SFD project budget.

Several other senior administrators prioritized the SFD project over other projects. The Deputy Vice Chancellor stated that the BG members decided to prioritise the new SFD building based on the University's Estates Strategy; the new SFD building project was necessary to consolidate academic activities on the main campus by closing a satellite campus and thus allowing for the sale of the

[43] The Financial Officer reported the total capital budget as £200, whereas the campus master plan development plan stated the budget was £250. It is not clear which figure was accurate, or whether the budget figure changed between the master plan development in 2007 and the time of the interview in 2013.

property. To achieve this objective, the University had to relocate the SFD to the main campus. Also, providing updated facilities for the SFD meant strengthening its research facilities, which was another University's interest. For decades the successive SFD Heads had stated the need to update the School's facilities, and the University administrators felt a need to respond to the SFD's requirement (SFD Head interview, April 2013).

As a result, the BG elected to increase the SFD project budget by prioritizing it over other future projects. However, based on its interest in the impartial budget allocation across schools and departments, the BG did not choose option A:

> …they came up with a Ferrarri or Rolls-Royce, and then we said, well, that's really nice, but actually, we can't afford one of those … we might be able to afford a Volvo...
>
> (Deputy Vice Chancellor interview, April 2013)

In the end, of the five budget options, the BG members chose Option B, a result of their prioritization of the SFD building project based on their interests in implementing the Estates Strategy and strengthening the SFD's research facilities. However, to avoid the excessive budget allocation to one school, they did not choose the most expensive option. Option B was selected to balance the BG's two interests: avoiding excessive budget allocation, and providing the SFD with the facilities necessary to accommodate its academic activities.

Notably, the BG's choice of budget options was not based on the types of spaces programmed for the building. The BG relied on the PM's experience to evaluate options A and B as those most appropriate to allow the SFD to continue its mission.

6.3.2 Change in atrium size and creation of a breakout space

After the revised project budget was set in November 2008, SFD members and the architects discussed how to reduce project costs. To meet this new budget target, the quantity surveyors proposed reducing the building footprint and thus the area of the atrium (Design team meeting minutes, January 2009). As a result, a reduction in the building footprint led to a reduction in the first floor area, and the first floor became unable to accommodate the informal rehearsal space.

The building atrium was originally intended to be a relatively large space to function as a foyer and theatre reception area (Architects interview, June 2013). However, the project team members and the SFD accepted the quantity surveyors' proposal, and the atrium was redesigned as a much narrower space. An atrium of this size and proportions could function only as a corridor, not a foyer (Structural engineer interview, August 2013). In addition to a smaller atrium, the informal rehearsal space was eliminated as the building footprint was reduced. To compensate for these changes, the architects proposed the design of a breakout space on the ground floor to replace the lost function of the atrium and the rehearsal space (Architects interview, June 2013). This new breakout space was intended to serve as a lounge, an informal rehearsal space and a foyer for theatre productions.

The architects' proposal to include the multi-functional breakout space was based not only on the SFD's original requirements, but also on the architects' desire to further develop their design. The architects sought to unify their ideas for the building by applying two aspects of their concept: informal interaction and flexibility.

In terms of the first aspect, from the project inception the architects emphasized the importance of an informal interaction space. As the atrium lost this function, the architects replaced it with the breakout space. The architects wanted to locate informal spaces in the building to function as its core and to contrast with the formal performance spaces. They highlighted this contrast between formal and informal spaces by locating the breakout space in the centre of the ground floor, flanked by the performance spaces. According to the architects, the space was designed to provide a "stimulating background to the activities taking place" in the performance spaces (Architects report, March 2009). In addition, by locating this space at the middle of the ground floor plan, the architects intended it to function as the nexus of circulation for the building. In fact, the architects referred to this space as “the heart” of the building, from which the building “grows” (Lead architect interview, June 2013).

Second, the multi-functionality of the breakout space reflected the architects’ other key design aspect, “flexibility”. Flexibility emerged as a key source of inspiration during the concept design phase, particularly after the shared storage space between Theatres 2 and 3 was added (SFD representative & Internal PM interview, April 2013). The location of this storage would facilitate productions, conferences and rehearsals in the two theatres. The architects also applied this concept to the design of the breakout space and its multiple functions. In fact, to describe its multi-functionality of spaces, one of the architects referred to this project as “jam-packed building” (Support architect interview, June 2013).

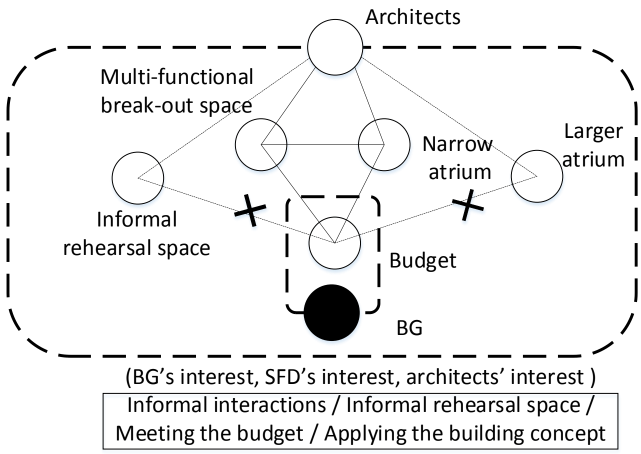

Figure 6-8 Architects’ problmatization about the creation of the breakout space

To summarise, due to the reduced budget, the architects revised their proposed space allocations by incorporating the SFD’s required functions for various spaces and the architect’s interests in further developing the design concept. Figure 6-8 illustrates the architects’ proposal to create the breakout space and the narrowed atrium (represented by the solid lines). As discussed above, the larger atrium and the informal rehearsal space were eliminated as a result of the revised budget (crossed dotted lines). The architects proposed a new spatial configuration to meet these constraints (black circle within the smaller rectangle).

6.3.3 A design change for the building entrance

At the end of the concept design stage a workshop was held, at which the architects presented the final concept design and renderings of the building facade. Some senior University administrators, including the Deans of Faculties and the Head of Project Management in the Estates Department, participated in this workshop, during which they announced a change in the entrance of the building. The administrators pointed out that the entrance would be difficult to see from the road that led from the main campus entrance, and proposed that the entrance should project from the front facade to be more visible to visitors. The University administrators' proposed design included two doors on the opposite sides of the walls which protruded from the originally straight line, facing the pathway leading from the main entrance to the central green space.

Based on their aesthetic interests, the architects opposed the proposed change, because they felt this idea was "a bit strange" (Lead architect interview, June 2013). The architects presented numerous renderings to convince the University of the visibility of the building's entrance in the original plan. However, despite the architects' opposition to this change, the University administrators strongly insisted on an entrance that protruded from the facade. The architects finally consented to change the shape of the entrance.

Interestingly, according to the internal PM, the University administrators involved had a strong interest in these architectural discussions:

> … [the University administrators are] not the architects. But… they do like to make decisions and be given options… we did have a lot of these architectural discussions... because it was important to the University that you saw that building at the end of the road from the roundabout...
>
> (Internal PM interview, April 2013)

This statement suggests the University administration's interest in campus visibility over the design of the SFD building. The administration, due to its power over the architects, did not have to limit their requests to the restrictions of the final design phase or budget restrictions. In fact, the administration approved the use of contingency funds to make the necessary changes to the entrance (Project committee meeting minutes, July 2009).

Depending on power relationships involved, the way some actor interests were incorporated over others varied with respect to the decision-making processes surrounding the three issues described above: the BG's budget decisions, the addition of the breakout space, and the University administration's requirement to change the entrance. In the first instance, the University administrators were solely in charge of the budget, and incorporated their two interests into this decision: avoiding excessive budget allocation and strengthening the SFD's research facilities. In the second, the architects proposed the change, incorporating their own interests as well as the SFD's requirements, while meeting budgetary constraints. Finally, in the third instance, University administrators imposed their preference, incorporating their own interests over the architects' concerns about modifying the entrance, while ignoring the budgetary constraints.

Various functional spaces were discussed at the concept stage. Figure 6-9 diagrams the complete rough floor plans at the end of the concept design. They showed that the performance spaces – two theatres, a screening room, and a TV studio – were located on the ground floor. All the performance spaces except for Theatre 1 were all double-storey height, which were roughly located at the four corners of the building and surrounded the central atrium, creating a bright entrance. When Theatre 1 became single-storey and was relocated to the first floor, a storage space was located between Theatres 2 and 3, where Theatre 1 used to be. Also, the breakout space was located in front of the storage space. The area of the first floor was limited, as the four double-storey performance spaces occupied the void spaces on the first floor. The academic staff's office areas were located on the second floor.

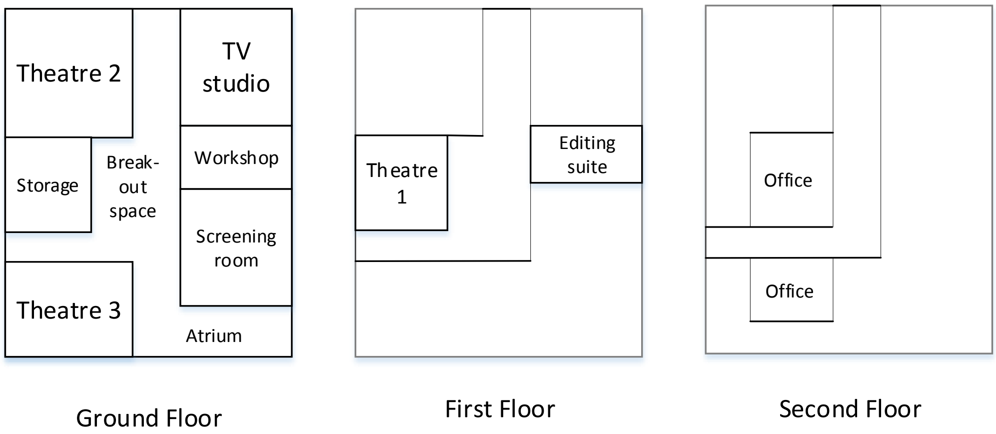

Figure 6-9 Floor plan diagrams at the end of the concept design[44]

6.4 Issues which arose as a result of the concept design

The concept design was finalised in February 2009. A number of project team members, including the structural and service engineers and the acoustician were actively involved at the detailed design stage. During this process, they changed their proposals based on the results of the concept design stage. This section introduces the decision-making processes regarding the project's structural and acoustic specifications as well as the selection of brick suppliers at this stage.

6.4.1 Noise rating levels of Theatre 1

In March 2009, an acoustician was brought on to the project to recommend acoustic design criteria for each functional space. These criteria were determined using the noise rating (NR) level of each space. Noise rating (NR) refers to "the maximum acceptable level in each octave band of a frequency spectrum, or to assess the acceptability of a noise spectrum for a particular application"(Technical Committee B/209 1999). Because acceptable sound levels vary depending on the purpose of a space, the acoustician discussed the acoustic criteria of each space with SFD members based on its use and the official standards regarding acoustic design for educational facilities. As a result of these

[44] This figure was created by the author for the purpose of diagramming the architectural floor to indicate the layout of the building while maintaining the confidentiality..

discussions, the acoustician proposed a level of NR 20 for the building's TV studio, NR 25 for the theatres and screening room, and individual office rooms at NR 30[45].

The acoustician was again involved in the project in October 2009, after the service engineers had set the specific services for each functional space. The acoustician checked whether the required NR level would be achievable in each space, and used the architectural floor plans and the diffuser product information to review these levels. As a result, the acoustician determined that the level of Theatre 1 would exceed the required NR 25 to reach NR 27, and proposed a change in the level:

> The 'single height' nature of this room results in a potential marginal exceedance of the noise level design criteria... This is not considered to be a significant non-compliance, but the client should be made aware of slightly raised noise levels in this room.
>
> (Acoustician report, October 2009)

This quote suggests the acoustician's call to accept a change in the NR level. The acoustician wrote that while the change in the NR level was not significant, the client should be aware of this change. However, the acoustician did not specify whether he referred to the SFD or the PM as "the client".

After the internal PM read the report, he copied the statement quoted above and forwarded it to the SFD. In response, the SFD representative asked the PM whether he thought this would be acceptable, and asked, "If it [the level] is fairly marginal we should be OK, shouldn't we?" The representative was unsure about what an increase in the NR level by 2 meant, and thus relied on the PM's expertise to decide. As a result, in response to the SFD's enquiry, the PM recommended accepting the new NR of 27 instead of forcing the acoustician to achieve NR 25:

> Yes. If it were one of the other theatres then I would say try harder. I don't think it will matter here, and the ceiling height limits our options anyway.
>
> (Internal PM email, October 2009)

This statement suggests the PM's support for the acoustician's proposed change, based on the fixed decision about the height of Theatre 1 presented in the architectural floor plans. The PM's task was to encourage project team members to accommodate the SFD's requirement. However, as the

[45] A lower NR number indicates a higher level of soundproofing.

decision about Theatre 1 entered the discussion, the PM recommended that the SFD accept the compromise on the required NR level of Theatre 1, while the SFD did not understand what a change in the NR level implied. Importantly, this analysis points to a change in who, in fact, represented "the client" at this time. In this case, because of his expertise, the PM represented "the client" instead of the SFD.

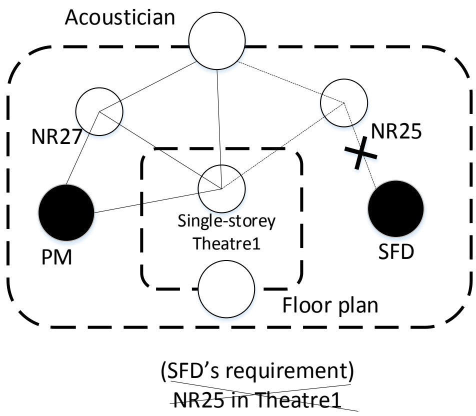

Figure 6-10 Acoustician's problematization of the NR level for Theatre 1

To summarise, the acoustician proposed a change in the NR level of Theatre 1 with respect to its ceiling height (Figure 6-10). The acoustician assumed that the SFD (black right circle) originally required an NR level of 25. The architectural floor plans fixed the decision about the single-height of Theatre1 (represented within the smaller rectangle). The PM (black left circle) accepted the acousticians' proposed change of the NR level with respect to the single-height of Theatre 1 (solid line). The SFD accepted the proposed change as the PM, a person with knowledge and expertise on the side of the SFD, recommended the SFD's compromise on the NR level of Theatre 1. As a result, the SFD's previous requirement of a NR level of 25 for Theatre 1 was not incorporated (crossed dotted line).

This analysis highlights the affect of the decision regarding Theater 1's height on the acoustician's proposal and the PM's role in the project. Specifically, the acoustician changed the proposed NR level of Theatre 1 from 25 to 27, and the PM changed his role of supporting the SFD's requirements to recommending a compromise to the SFD. This is because the new requirement of Theatre 1 hampered the accommodation of the SFD's requirements. The analysis also reveals a discrepancy between the SFD's actual interests and what were considered as these interests. Although the acoustician assumed that the SFD required an NR level of 25, the SFD did not understand the difference between NR levels 25 and 27. In addition, this discussion suggests a change in the client representation, as the PM represented "the client" instead of the SFD in this decision.

6.4.2 Structural design of composite beams

In February 2009, during the concept design stage, the structural engineers proposed the basic structural design, including that of the foundation, the cladding and the floor system. The engineers had already selected a steel frame as the building structure, and offered two options for floor systems compatible with this structure: metal-decked composite concrete or a pre-cast concrete system. Ultimately, based on their interests in ease of construction, the engineers recommended the metal-decked concrete system, largely because they were aware that the SFD building involved some complexity in terms of architectural and services design, including its irregular floor layouts, curved slab edges, complex building services and specialist theatre equipment (Service engineers report, February 2009).

However, after the acoustician and the architects became involved in the discussion, the structural engineers changed their recommendation to a different beam design (Structural engineers report, July 2009). The acoustician was interested in minimising sound leakage across different rooms and floors, and the architects were concerned about maximising the ceiling height of the theatres to allow for sufficient clearance below suspended ducts and lights, particularly for the single-storey Theatre 1. Based on these interests, the structural engineers proposed a solid pre-cast concrete slab as the floor deck. This design would incorporate pre-cast concrete slab and in-situ concrete methods, with the in-situ concrete topped over the pre-cast concrete slab. Also, sheer stud connectors were to be welded at the top of the beams. For this new design, the various components – the sheer studs, the slab and the beam – were combined to function as unified components. This design accommodated the acoustician's interest, as the design of seamless junctions of structures (beam/slab and wall/slab) minimised the potential for sound leakage. The architects' interests were also incorporated into this new design, as the beams now gained additional structural strength because of the unified components, which allowed for a 30% reduction in beam area (Structural engineer interview, August 2013). As a result, the ceiling height of all three theatres could be raised.

This analysis describes how the structural engineers altered their design by incorporating both the architects' and the acoustician's interests in minimising sound leakage and maximising theatre ceiling heights. The structural engineers developed the design which consisted of a number of different components, including beams, slabs, a metal deck, pre-cast concrete in order to incorporate the acoustician's and the architects' interests. However, this decision did not serve the earlier structural engineers' interest in simplified construction methods.

6.4.3 Selection of brick suppliers

When originally designing the building, the architects were concerned about the large windowless areas that comprised most of the building facade, as none of the performance spaces contained windows. As a result, the architects considered selecting special brick cladding to mitigate the visual effect of the windowless exteriors. They proposed using bricks longer than standard with a colour variation from red to blue:

> … we went with these very, very long bricks, we wanted something really, special … if it's standard bricks, it looks awful, it's such a big area.
>
> (Lead architect interview, June 2013)

This statement suggests the architects' desire to maintain a visual balance between the brick and the windowless facade, based on decisions made during the concept design stage. After the architects specified the brick cladding, the project team members elected to use a single brick supplier to ensure consistent materials. Also, the architects required the delivery of sample panels of the selected brick on site prior to construction to determine that the colours were appropriate to the design[46] (Contractor interview, September 2013).

However, in March 2010, the arrival of the brick sample panels was delayed, as the factory had stopped production due to the Christmas holiday break. The supplier wrote:

> We have had some production problems since our return from the Christmas break but these have now been resolved. As soon as the panels are available they will be despatched on the same day.
>
> (Supplier email, March 2010)

This statement suggests that the supplier intended to deliver the panels as soon as possible. The architects, the PM and the contractor discussed how to deal with this delay, during which time the external PM wrote:

> The fear is that if a few bricks are this hard to get out of them [the supplier], what will it be like for the main order? The contractor has managed to get a small sample from the competitor.
>
> (External PM email, March 2010)

This statement suggests the PM's proposal to change the brick supplier. The PM balked at the supplier's proposed delivery date, which was later than was originally specified. The contractor copied the PM's statement and forwarded it to the supplier, asking him again to fulfil the original delivery date:

> As per our telephone conversation I have attached the email below for reference. As agreed, we are extremely concerned with this situation and I am positive it would be a massive disappointment for you to lose the order at this stage. I am aware there have been some issues with the supply of these bricks, but the time for allowance has now gone.
>
> (Contractor email, March 2010)

This quote suggests the contractor's strategy to persuade the supplier to deliver the sample panels as soon as possible, despite production problems. The contractor assumed that the supplier was interested in completing the order, so he leveraged the PM's proposal to change suppliers. As a

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[46] The difference in the colour was created in the factory, which depended on the location of bricks on the kiln in a firing process. Thus, it was important to check the sample panel to see if the bricks had the right colour before ordering the bricks for the main construction.

result, the contractor persuaded the supplier to change his delivery date, thereby incorporating his interest in filling the order. The contractors' strategy was successful, and the supplier delivered the sample panels on the day after the contractor sent his email.

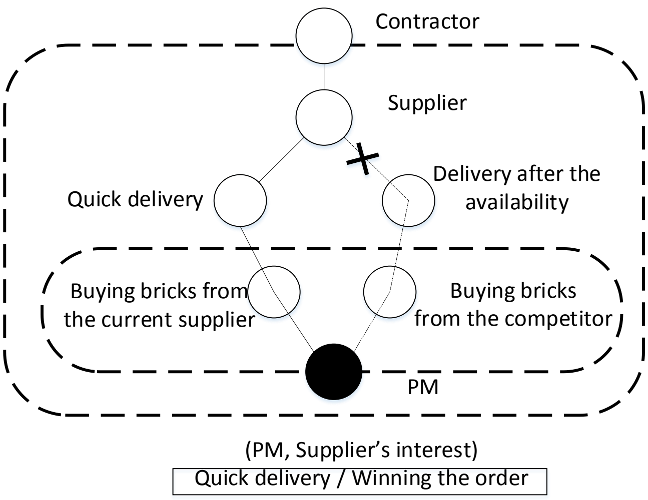


Figure 6-11 Contractor's problematization of timely brick panel delivery

To summarise, the contractor persuaded the supplier to change his delivery date by using the PM's statement discussing a change in suppliers (Figure 6-11). The PM's email proposed a change in the supplier if delivery was delayed (represented by the smaller rectangle). The contractor assumed that the supplier was interested in keeping the business, and to incorporate this interest, the supplier would accept the suggested prompt delivery (represented by the solid lines). As a result of the contractor's successful persuasion, the project team members' desire for quick delivery of sample panels and the supplier's interest in winning the order were incorporated into a change in the supplier's proposed delivery date.

Various changes in actor proposals were illustrated in the decision-making process regarding the three issues discussed above: the NR level of Theatre 1, the structural design of the beams, and the selection of brick suppliers. In the first instance, the acoustician changed the proposed NR level based on the decision to reduce the height of Theatre 1 to a single-storey. In the second instance, the structural engineers changed their design to incorporate the architects' and acoustician's interests. Finally, in the third instance, the brick supplier changed his delivery date by accepting the contractor's assumption of the supplier's interest.

6.5 Incorporation of actor interests into space allocation decisions

Selective actor interests were incorporated in the decision-making processes regarding the discussion of SFD space allocation. This discussion included: briefing document development (Sections 6.1.1-6.1.2); area, location and adjacency of functional spaces (Sections 6.2.1-6.2.4); changes in the space allocation following a budget decision (Sections 6.3.1-6.3.3); issues arising as a result of decisions made during the concept design stage (Sections 6.4.1-6.4.3). Table 6-2 shows the proposals associated with each of these issues, the key actors involved and actor interests that were incorporated (IN) and not incorporated (NIN) at each moment of the process. In this context, the term *actor interest* includes requirements which one ascribed to another. For example, the SFD's requirement for the NR level 25 was ascribed by the acoustician to the University.

A number of different actors were involved in the space allocation discussion, including University members (SFD, PM, and BG), project team members (architects, acoustician, structural engineers and contractor) and a series of documents (space need indicator framework, concept sketch, architectural floor plans).

The process of selecting which actor interests to incorporate varied by issue. A number of the University's and the architects' interests were successively incorporated in the briefing documents (6.1). The SFD and the architects prioritized some spaces, incorporating the SFD's interests in some but not others (6.2.1-6.2.4). Power relationships influenced the incorporation of the University's interests over the architects' (6.3.1-6.3.3). The structural engineers and the acoustician changed their proposals, leading to the incorporation of some actor interests over others (6.4.1-6.4.3).

Table 6-2 Incorporation of actor interests into the proposals about space allocation

	Proposal	Key actors	The incorporation of actor interests
6.1	Development of briefing documents	SFD, architects, PM	**IN:** (SFD) Including additional rehearsal space aside from formal performance spaces; facilitating the SFD's academic activities (Uni) preventing the excessive provision of spaces (architects) creating a informal interaction space; designing a welcoming building entrance
6.2.1	SFD suggestion to increase storage and reduce dressing room areas	SFD, architects	**IN:** (SFD) Creating a storage space to accommodate large set pieces **NIN:** (SFD) Separating dressing rooms by gender
6.2.2	Architect proposal of single-storey height for Theatre 1	SFD, architects	**IN:** (SFD) Inclusion of all three theatres (architects) opening the ground floor **NIN:** (SFD) Lighting aesthetics; mitigating heat effects on performers
6.2.3	Architect proposal of shared storage space between Theatre 2 and 3	SFD, architects	**IN:** (SFD) Production flexibility for Theatres 2 and 3; larger storage spaces **NIN:** (SFD) Production flexibility for Theatre 1
6.2.4	Architects' proposal of windows in the stairwell rooms	SFD, architects	**IN:** (SFD) Easy access from performance spaces to control rooms (architects) easing the austerity of the building exterior; enlivening façade
6.3.1	BG budget decision	BG, PM	**IN:** (BG) Implementing estates objectives; strengthening SFD research facilities; avoiding excessive budget allocation **NIN:** (BG) Implementing all other future projects
6.3.2	Architect proposal to create breakout space	SFD, architects, budget decision	**IN:** (SFD) Requirements for functions of atrium and informal rehearsal spaces (architects) balancing formal and informal performance spaces
6.3.3	University proposal to change the entrance	University, architects	**IN:** (Uni) Visibility of entrance from building exterior **NIN:** (architects) Aesthetic interest
6.4.1	Acoustician proposal to change NR level in Theatre 1	SFD, acoustician, PM, floor plans	**NIN:** (SFD) Required Theatre 1 NR level
6.4.2	Structural engineer proposal for floor system structural design	Structural engineers, architects, acoustician	**IN**: (architects) Maximising theatre ceiling height (acousticians) seamless structural component joints **NIN:** (structural) Easy construction
6.4.3	Contractor proposal to change supplier delivery date of sample panel	Contractor, brick supplier	**IN**: (architects) Confirmation of sample panel before construction (PM) supplier delivery on time (supplier) winning the bid

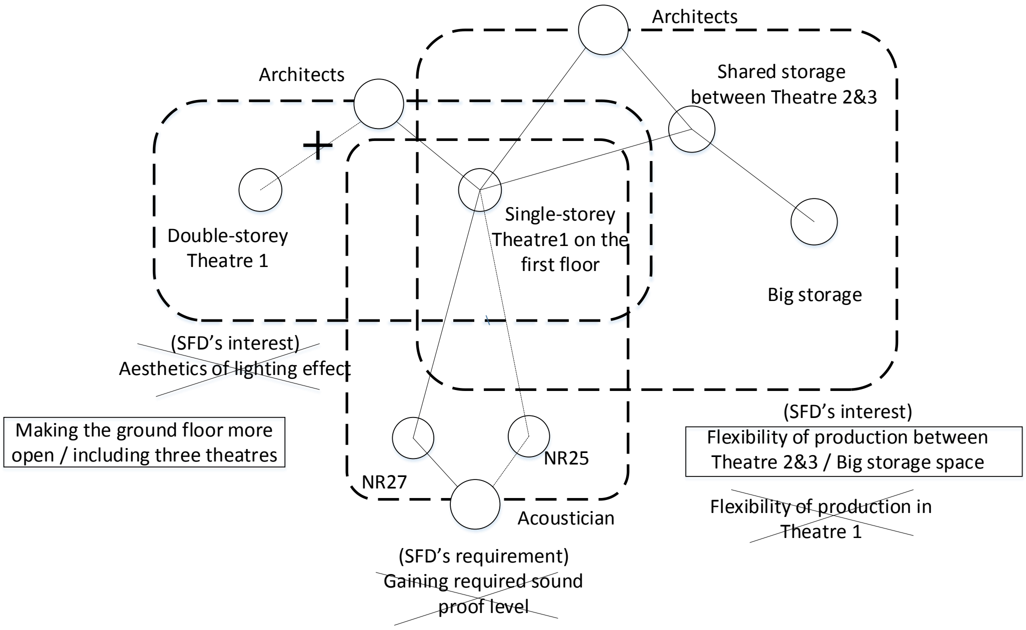


Figure 6-12 Actors' successive problematizations about space allocation around Theatre 1[47]

Among all the issues related to space allocation (6.1-6.4), decision-making processes around Theatre 1 (6.2, 6.4.1) involved a number of client interests (i.e. the SFD) in the height, location and the sound proofing level of Theatre 1, a storage space, Theatre 2 and 3. Figure 6-12 illustrates the architects and the acoustician's problematizations with respect to Theatre 1, in which some client (i.e. the SFD) interests were privileged over others. The SFD accepted or rejected the architects' proposals with respect to the area and location of a number of spaces, which were interdependent to Theatre1. More specifically, the proposed height of Theatre 1 had implications for a number of other decisions or proposals including: the area of the building footprint, the location and dimensions of the shared storage space, and the NR level of Theatre 1. As a result, client interests were incorporated into the location, adjacency and dimensions of the shared storage space (all of which were interdependent to Theatre 1). However, client interests were not incorporated into the height and NR level of Theatre 1.

The analysis describes the architects' power to impose their interests. The architects were successful in dictating the design of the functional relationships between various spaces, which allowed them

[47] To highlight the interdependencies between problematizations the diagram leaves out the SFD as an actor.

to impose their preferences. For example, during the space allocation discussion (Section 6.2), the architects proposed locating the single-storey Theatre 1 on the first floor, which required the SFD to compromise. To persuade the SFD, the architects presented the building footprint restriction in their concept and floor plans, which limited the accommodation of all of the SFD's functional space requirements, and thus, showed a need of compromise about some spaces. Also, the architects demonstrated that locating a shared storage space between Theatres 2 and 3, which was supported by the SFD, depended on the decision to reduce the height of Theatre 1, which was not favoured by the SFD. Similarly, the acoustician drove the SFD's compromise on the soundproofing level of Theatre 1. He showed the PM that his proposed change in the NR level was based on the decision to reduce Theatre 1 to a single storey. Significantly, by linking their proposals and decisions, the architects and the acoustician persuaded the SFD and the PM (i.e. the clients) to accept their suggestions.

Material object facilitated the architects' persuasion processes. More specifically, their proposals and decisions were specified in the floor plans, which included the area and height of each functional space, adjacencies between functional spaces, functional space locations and the building footprint area. These "materialized" proposals and decisions presented in documents facilitated the client's understanding that proposals about particular spaces shaped or limited the range of options about other spaces or issues, which required the clients to compromise.

In contrast to the architects, the University members exercised a different power. The University administrators had the privilege of making primary decisions and selecting from existing proposals. In the development of the project brief (Section 6.1), the SFD proposed its required functional spaces, which became the basis for the architects' space allocation plans. Also, the University administrators determined the budget, which further drove space allocation discussions (6.3). Finally, in the concept phase, the University administrators proposed changing the building entrance despite the architects' opposition, incorporating their own interests over those of the architects.

A shift in power relations was analysed with respect to discussion of space allocation. The power of the clients was seen in the choice of some proposals over others, while the power of the architects depended on arguments regarding the interdependence between their proposals and the already fixed decisions. As interdependencies between issues increased, the project team members gradually gained power to impose their proposals. The project team members mobilized different issues and actor interests in order to specify or modify proposals. By doing so, they prioritized some client interests over others.

7 Mechanical space size

Beginning in 2009, discussions began among the School of Film and Drama (SFD) members, the project manager (PM) and other project team members about the area and location of the SFD building's mechanical system. At the beginning of this process, the services engineers and SFD members considered the selection of an appropriate ventilation system for the performance spaces. Following this discussion, the services engineers, the structural engineers and the architects discussed issues surrounding the mechanical system design. At the same time, the architects and the services engineers debated the location of the mechanical space that would house the HVAC (heating, ventilation and air conditioning) systems and equipment. As a result, additional questions regarding the acoustic design of the floor of the mechanical space arose. Table 7-1 lists an abbreviated timeline for this decision-making process and the key actors involved.

Table 7-1 Timeline of key moments in the decision-making process of the mechanical space size

	Decision-making processes	Actors	Date
7.1	Selection of standard ventilation system over a displacement system	Services engineers, SFD representative	Mar-Apr 2009
7.2	Issues surrounding mechanical system design	Services engineers, structural engineers, architects	Mar-Oct 2009
7.3	Location of the mechanical space discussion	Architects, services engineers	Feb-Oct 2009
7.4	Acoustic design for the mechanical space floor discussion	Acoustician, contractor, PM	Oct 2009-April 2011

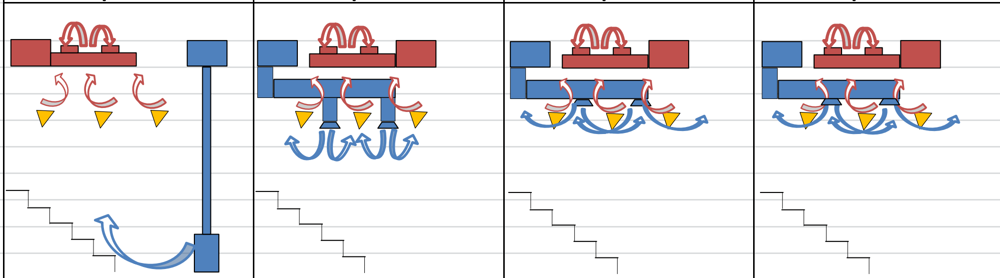
The analysis highlights how project documents shaped or limited the availability and appropriateness of subsequent design options. This process led to the incorporation of some actors' interests over others.

7.1 Ventilation system selection

The SFD building was designed to accommodate five large performance spaces: three theatres, a screening room and a TV studio. As maintaining appropriate air quality for each space would require a large volume of air exchange, in March 2009, the architects, the services engineers and the PM met to discuss the selection of a ventilation system.

In this meeting, the services engineers reviewed various ventilation system options and explained the merits of each. Figure 7-1 shows the document the services engineers presented to evaluate the ventilation system for the performance spaces[48].

Theatre HVAC Comparison



Criteria	Option 1 Displacement Ventilation	Option 2 High level cooled supply level with lights	Option 3 High level cooled supply above lights	Option 4 High level mechanical vent above lights
Air handling plant	Full fresh air with heat recovery	Variable fresh air/recirc	Variable fresh air/recirc	Variable fresh air/recirc
Cooling plant	Air cooled, roof mounted chiller(s)	Air cooled, roof mounted chiller(s)	Air cooled, roof mounted chiller(s)	None
Supply air temperature	19°C	14°C	14°C	External ambient - up to 34°C
Temperature in occupied zone	21-25°C	21-25°C	21-25°C	21-38°C (prelim estimate, subject to modelling)
Temperature in lighting zone	Warm - most of heat from lights removed without contributing to cooling load	Warm - about 40% of heat from lights removed without contributing to cooling load	Cool - Heat from lights adds to cooling load	Hot - Heat from lights increases high level temperature further
Room air quality	Very good - Supply air replaces rising air in occupied zone	Good - high degree of mixing of of supply and room air	Good - high degree of mixing of of supply and room air	Reasonable - high degree of mixing of of supply and room air but warmer
Approx total air changes per hour	5	7	9	5
Approx fresh air changes per hour	5	5	5	5
Compliance with Part L2 overheating criteria	Yes	Yes	Yes	Possibly but needs thermal modelling to predict hours of exceedance

Figure 7-1 Ventilation system option table (the services engineers' report)

A standard HVAC ventilation system (shown as Options 2, 3 and 4 in Figure 7-1) typically consists of supply ducts (represented in blue in the document) and a return ducts (represented in red) installed near the ceiling of a room. For this project, selection of a standard HVAC system meant that chilled air would travel near the light fixtures, thus using additional energy to cool the heat generated from the lighting system. In contrast, a ventilation displacement system (Option 1 in Figure 7-1) typically employs supply ducts (represented in blue) installed at the lower level of walls, and return ducts

[48] It is not clear when the services engineers created this document or whether it was used in either the project team members' external meeting or in the meeting with the SFD.

(represented in red) at higher levels (represented in yellow). For this project, such a system would circulate cool air near the floor level and seating areas, thus wasting less energy on cooling light fixtures.

As a result, based on their interest in maximising energy efficiency, the services engineers recommended the adoption of the displacement cooling system. However, during this meeting the SFD rejected the services engineers' recommendation, because the project required that curtains be placed around the perimeter of all three theatres, and would block air from supply ducts installed at lower levels. Furthermore, these curtains were essential for the SFD's interest in the flexible use of performance spaces. For example, adjusting the curtains can change sound quality, expose or cover a wall, change the colour of the stage background, or create wings or temporary dressing spaces between curtains and walls (SFD representative interview, July 2013).

After the SFD representative declined the displacement system, the services engineers and the architects proposed the use of an under-floor plenum (an enclosed space under floor which facilitates air circulation). This system would allow for the use of both curtains and the displacement ventilation system by allowing air from supply ducts to pass through the plenum in areas surrounded by curtains. This proposed solution would have incorporated both the SFD's interest in flexible use of theatres and the services engineers' interest in saving energy, or sustainable design. However, the project team members concluded that a plenum would be too expensive (Design team meeting minutes, April 2009). While it is not clear who turned down the plenum option, most of the project team members seem to have been aware of the project's budget constraints and the extra expense of this more sustainable ventilation system[49].

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[49] The SFD representative suggested the difficulty of implementing reduced energy solutions for this project in her interview: "…the building is not easy to make green … and also, it was… expensive… some of the things we would have liked to make the building greener were just not possible" (interview, SFD representative, April 2013).

In the end, the services engineer and the SFD representative chose a standard ventilation system over a displacement system[50]. As a result, the SFD's interests in the flexible use of the building's theatres and the project team's interests in reducing cost were incorporated into this decision, but the services engineers' interest in energy efficiency was not.

However, the selection of a standard ventilation system had a significant impact on another issue: the size of air-handling units (AHUs) to make this system work. The services engineers' appraisal of ventilation system options (Figure 7-1) indirectly affected the size of AHUs, as the document presented approximate ratios of total air exchange per hour for each option. The total air exchange capacity of the displacement system was 5, whereas the standard system capacity was 7 or 9, which would be 1.2 or 1.4 times larger capacity than the displacement system. This meant that the standard ventilation system would require much larger air handling units (AHUs) to house the air exchange of this capacity. The architect recalled the impact of this decision on the services engineers' plan:

> … and we [the services engineers and the architects] went into the meeting with the SFD representative… and she [the SFD representative] said, that wasn't going to work at all… because we've got curtains all around our theatres! … This sort of very basic thing was going to completely ruin their whole plan…
>
> (Lead architect interview, June 2013)

This statement suggests the affect of the SFD's unexpected rejection of the proposed ventilation system, which became known for the first time during this meeting. However, it is unclear if the SFD representative understood the impact of this decision, as her account suggests a limited understanding of the building's mechanical systems:

> …anything to do with the plant [mechanical system], I know nothing about… I listened in to a lot of discussions, but I couldn't say I knew much about it.
>
> (SFD representative interview, July 2013)

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[50] In the interviews with the services engineer and the SFD representative, it was not clear which ventilation option (of Options 1-3) was chosen.

This statement suggests that the SFD chose the ventilation system without much understanding of or interest in its affect on the size of the mechanical space.

7.2 Issues surrounding mechanical system design

The chosen ventilation system affected the size of the mechanical space area, and the services engineers' design of duct routes based on this system influenced the overall project design. This section analyses three challenges related to the service design process: 1) the calculation of the AHU dimensions; 2) the proposed beam design with respect to the duct routes; and 3) the appearance of these ducts in the atrium.

7.2.1 Calculation of AHU size

The services engineers determined the required air exchange volumes for each building space using a number of variables, including acceptable temperature range, maximum occupancy, and ventilation system for each space.

In August 2008, the services engineers tentatively set the acceptable temperature range for each functional space according to CIBSE Guide A (2005), which suggested that the acceptable maximum temperature of performance spaces (in this case, the theatres, TV studio, and screening space) was 22-23°C in cooler months and 24-25°C in warmer months. The services engineers circulated this information in a report (Services engineers report, August 2008) to the SFD and the PM and asked them to comment on these temperatures. In response, the external PM commented that the range suggested by the CIBSE guide was neither "affordable, nor really necessary" (External PM comment, August 2008).

Additionally, the services engineers proposed an alternative temperature range criterion in their report, namely that the performance spaces should "not exceed 28 °C for more than 1% of occupied hours," the minimum requirement stipulated by the building regulations[51]. This criterion was based

[51] It was not clear from the report which Building Regulations the services engineers were referring to.

on the services engineers' assumption of the University's interests in "lower energy solutions[52]" (Services Engineers report, August 2008). In response to this proposed criterion, the SFD representative stated, "it is difficult to comment on temperatures. The CIBSE recommended temperatures sound fine to me". This quote suggests the SFD's limited understanding of or interest in the acceptable temperature ranges for the performance spaces. However, in response to the PM's enquiry about the acceptability of a 28°C maximum, she commented that exceeding this temperature for short intervals would be acceptable, as theatre temperatures typically rise beyond this level during performances due to lights and the presence of an audience. In the end, the PM accepted this proposed criterion:

> The main point is that the limited funds we have available would not be well spent on a plant [mechanical system] designed to provide a closely controlled environment capable of maintaining a constant internal temperature…
>
> (External PM email, September 2008)

The quote suggests the PM's interest in avoiding the costs incurred by excessive temperature controls. In the end, based on the services engineers' assumption of the University's interest in conserving energy and the PM's interest in reducing costs, the maximum temperature of performance spaces was determined not to exceed 28°C for more than 1% of occupied hours.

In addition, the services engineers discussed the maximum occupancy of each functional space with the SFD representative, who estimated the number of students who would typically occupy each space. This information was used to satisfy the SFD representative's interest in carrying out the School's academic activities in comfortable environment.

Finally, the ventilation system selection was used to determine the volume of air exchange and appropriate AHU size for each space. In a February 2009 report, the services engineers drafted an area schedule using the above variables (Figure 7-2). This schedule listed minimum and maximum

[52] These engineers stated that one difficulty in setting acceptable temperatures was that the University did not have its own heating policy. This was confirmed by the PM, who checked with the Estates Department.

acceptable temperatures, maximum occupancy figures and the anticipated ventilation system for each space.

Name	Department	Area	Occupancy			Design temperature		Noise Level	Comments
		m²	Normal	Maximum	Frequency of Maximum	Summer °C	Winter °C	NR	
Theatre 2	Specialist Teaching	233	42	205	Int	24-25	22-23	20-30	
Workshop Constr/Costume	Specialist Teaching	98	8	8	Daily				
TV Studio	Specialist Teaching	98	8	8	Daily	21-23	19-21	25	
TV Studio Manager	Specialist Teaching	9	1	1	Daily	22-24	21-23	35	
Screening Room	Screening Room	76	10	60	Int			20-30	
Prop Store	Admin/Support Offices	87	0	8	Daily				
Theatre 3	Specialist Teaching	191	25	50	Int	24-25	22-23	20-30	
Make-up/Dressing	Specialist Teaching	13	2	4	Daily			35	
Switch Room	Plant	17	Int	Int	Int				
IT Hub	Plant	19	Int	Int	Int				
Drama Tech	Admin/Support Offices	10	4	4	Daily	22-24	21-23	25-35	
Chief Tech	Admin/Support Offices	9	4	4	Daily	22-24	21-23	25-35	
Female WC	WC	12	Int	Int	Int	21-23	19-21	35-45	
Disabled WC	WC	3	Int	Int	Int	21-23	19-21	35-45	
Male WC	WC	10	Int	Int	Int	21-23	19-21	35-45	
Primary Circulation	Primary Circulation	163	15	150	Int	21-25	13-20	40	
Theatre 1 Riser	Plant	3	n/a	n/a	n/a	n/a	n/a	n/a	
Link Theatre 3 Prop Store	Primary Circulation	7	0	2	Daily				
Fire Core 1	Primary Circulation	25	Int	Int	Int				
Admin/Reception	Admin/Support Offices	20	2	2	Daily	22-24	21-23	35	
Riser 1	Plant	3	n/a	n/a	n/a	n/a	n/a	n/a	
Theatre 2 Riser	Plant	3	n/a	n/a	n/a	n/a	n/a	n/a	
Theatre 2 Light Lock	Primary Circulation	5	0	2	Int				
Service Access	Primary Circulation	16	Int	Int	Int				
Fire Core 2	Primary Circulation	13	Int	Int	Int				
TV Studio Light Lock	Primary Circulation	4	0	2	Int				
Breakout/Informal Rehearsal	Specialist Teaching	43		10	Daily				

Figure 7-2 Services engineers' proposed area schedule (table from services engineers' report)

The AHU size for each space was determined using the three variables listed above: acceptable maximum and minimum temperature, maximum occupancy, and ventilation system. While the third variable, the selection of ventilation system was based on the SFD's interest in flexible use of theatres, other client interests were also incorporated through the calculation process through the use of the first two variables: the services engineers' assumption of the University's interest in conserving energy, the PM's interest in saving the costs of excessive temperature control, and the SFD's interest in maintaining its academic activities.

7.2.2 Coordinating beam design with duct routes

After the services engineers mapped the service duct routes from the AHUs to each performance space, the architects, structural engineers and services engineers discussed a structural beam design to accommodate these routes. This design changed over time, as it reflected various actors' interests at different points.

To maximize the useable area of the performance spaces, the architects proposed employing beams designed with holes through which ducts could run (Design team meeting minutes, March 2009). To incorporate this proposal, the structural engineers suggested using 1000mm deep cellular beams, with 550mm diameter holes (Structural engineers drawing, April 2009) for the performance areas and 500mm solid beams for the other spaces (Figure 7-3).

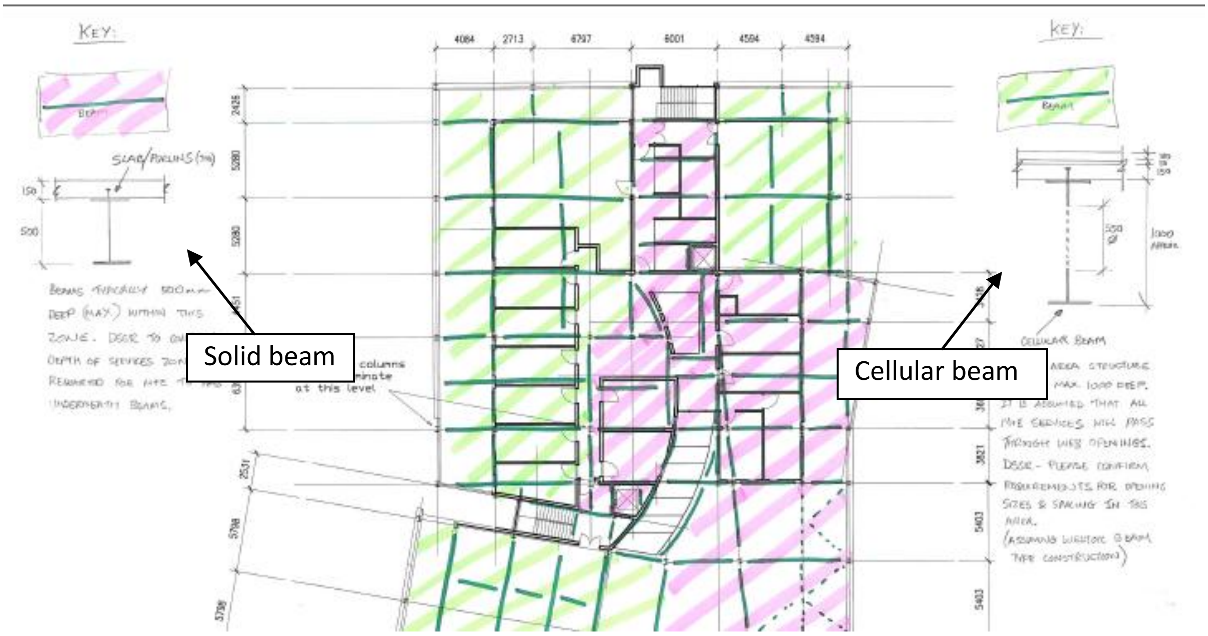


Figure 7-3 Structural engineers' proposal for beam design of each space (from structural engineering drawing)

While the final decision on beam design was inconclusive, the structural engineers proposed pre-cast and in-situ concrete for the design of the floor system. Because this method allows slabs and beams to behave as unified components, it made the use of composite beams possible and allowed the structural engineers to reduce the depth of these beams[53]. Furthermore, because the depth of the solid beams was reduced significantly, there was no need to employ cellular beams to maximise performance area space. As a result, the architects' interest in maximising performance room space was incorporated into the use of composite, not cellular, beams. They even considered that the ducts could run under these beams (Design team meeting minutes, June 2009).

However, based on the structural engineers' interest in easy construction, they still considered using cellular beams for the long spans in Theatres 2. Cellular beams weigh less than solid beams, and thus

[53] The structural drawings in May 2009 presented the depth of the cellular beams for Theatre 3 as 533mm and the solid beams for Theatre 2 as 305mm. This suggests that the beam depth was significantly reduced. However, this could be due to other factors, such as reduced roof weight.

make construction easier (CDM coordinator report, September 2009). Although beams in Theatre 3 would also support long spans (Design team meeting minutes, August/September 2009[54]), cellular beams were not selected for Theatre 3. This was because the services engineers changed the duct route design to run parallel to the beams in Theatre 3, negating the need for cellular beams in this space (Structural engineer interview, August 2013).

This analysis highlights changes in the structural design over time based on a number of actors' interests and proposals. First, the structural engineers proposed using cellular beams in all theatres based on the architects' interest in maximising performance space. Second, because the proposed floor system significantly decreased necessary beam depth, the structural engineers limited the use of cellular beams to Theatre 2. Finally, as the services engineers revised their proposed duct routes, the structural engineers suggested using solid beams for Theatre 3.

7.2.3 Atrium duct design

In October 2009, the services engineers finalised their mechanical design drawings, which specified two 1500mm by 600mm ducts running along the ceiling of the atrium from the roof AHUs to Theatre 3 (Figure 7-4).

To obscure these ducts, the architects proposed the use of a raft ceiling, a free-hanging unit that would cover them (Design team meeting minutes, December 2009). This idea was based on the architects' interest in the atrium's aesthetics and reducing duct noise. However, installing a raft ceiling would incur additional costs for a fire protection system (Design team meeting minutes, January 2010). As a result, the architects proposed an alternative, which was to leave the duct work exposed and paint it black (Design team meeting minutes, December 2009). In the end, based on

[54] The structural engineers raised this issue twice: "Theatres 2 and 3 have castellated beams – in Theatre 3, these aren't being used so we could have solid beams if the cost is the same. These are to be left in for now for possible future value engineering." (Design team meeting minutes, August 2009) However, the specific value engineering method was not clear, and the minutes suggest that the costs for solid and cellular beams were the same.

their interest in avoiding additional costs, the project team elected to adopt this option (Architects interview June 2013; Internal PM interview, April 2013).

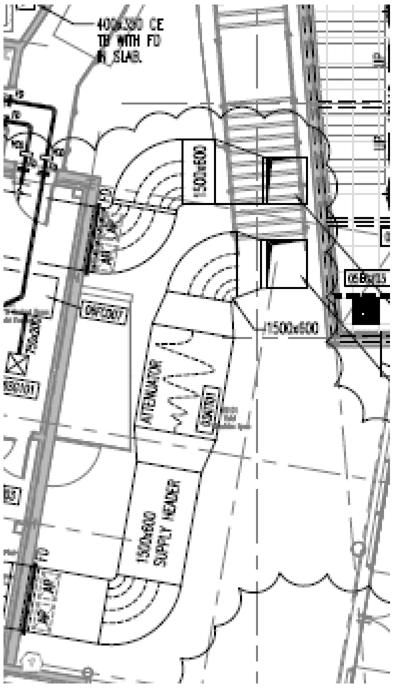


Figure 7-4 Atrium duct design (detail from the mechanical design drawings)

The SFD Head accepted painting the ducts as a design feature;

> … I suggested that … from the design point of view, I like the idea that… the pipes are exposed… like in the… Pompidou centre[55] in Paris…
>
> (SFD Head interview, April 2013)

In other words, the SFD Head's aesthetic interest differed from the architects', as he regarded exposing the ductwork as a design feature, drawing on the Pompidou Centre as an example.

The analysis highlights a conflict between the SFD Head and the architects' preferred design options, even though both of them were interested in aesthetics. Figure 7-5 shows the atrium in the completed building in which the duct work is exposed.

[55] Pompidou centre is designed by Richard Rogers and Renzo Piano, with external services as well as the structural system placed outside the building envelope. According to the official website, "In the 27 years in which the building has been open, it [Pompidou Centre] has become the most visited building in Europe and continues to attract some seven million visitors a year" (Rogers Stirk Harbour + Partners Llp 2015).

Figure 7-5 Exposed atrium duct (details from the architects' image of the complete building)

The decision-making processes surrounding the above three services design challenges (i.e. calculating the mechanical space size, altering the structural beam design and designing the atrium ducts) highlight how diverse actors' interests were incorporated into design decisions. First, some client interests (i.e. those of the SFD representativeand the PM) were incorporated into sizing the mechanical space by determining the volume of air exchange for each functional space. Second, the structural engineers changed the proposed beam design based on various actors' interests and fixed decisions at different points in the process. Third, the SFD Head's preferred design option was chosen, although this was not the architects' preferred option regarding decision to expose the ducts.

7.3 Mechanical system location

The area of the mechanical space significantly increased after a standard ventilation system was chosen. As a result, the architects and the services engineers frequently discussed an appropriate location for this space. First, the architects proposed constructing a mezzanine[56] on the roof, and locating the boiler and chiller above the AHUs. Second, as the idea of a mezzanine was abandoned, the required area for mechanical system increased on the roof of the first floor, which resulted in a

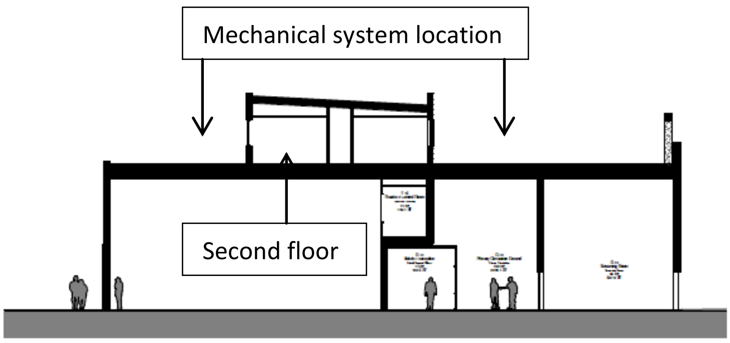
[56] "Mezzanine" is supposed to be an intermediate floor between main floors of a building. However, in this project, the architects referred to "mezzanine" as a semi-permanent floor system structure used specifically for placing mechanical system equipment on the roof.

change in the size and layout of the second floor[57]. Finally, the architects proposed to locate the AHUs, the boiler room and the chiller on the roof. However, a number of set decisions and newly informed product requirements limited the options for locating the mechanical space.

7.3.1 Locating the mechanical space on the second floor

In their February 2009 report, the services engineers raised this issue of mechanical space location, and proposed placing the AHUs and boiler room on the roof and the chiller on the ground floor. The services engineers proposed placing the chiller on the ground floor to minimise noise transmission to the inside of the building (as chillers typically vibrate due to air movement) and easy maintenance access to the mechanical space. While at this point the decision regarding the mechanical space location was inconclusive, the ground floor plan was fully occupied by performance spaces, thus leaving no room to accommodate a mechanical space.

As a result, the architects considered how to locate the mechanical system on the roof. As discussed previously, the standard ventilation system was chosen in April 2009, which necessitated an increase in the size of the AHUs. The architects wanted to decrease the area of the mechanical space which would influence the size of the second floor. Because the mechanical system was located on the roof, an increase in the area of the mechanical system would cause a decrease in the second floor space (Figure 7-6).



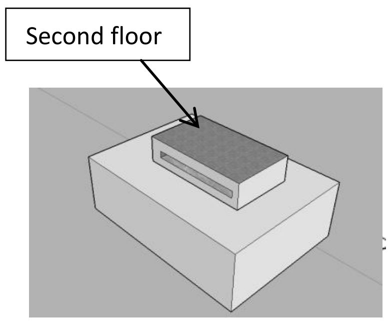


Figure 7-6 Section of the building (cut in Theatre3)[58]

[57] The second floor covered only a part of the building area. As the mechanical system was located on the roof of the first floor, surrounding the second floor space, an increase in the area of the mechanical system influenced a change in the size and shape of the second floor space. See Figure 7-6.

As a result, the architects proposed setting up a mezzanine on the northern side of the roof (Architects floor plans, March 2009). More specifically, the architects proposed locating the boiler and chiller above the AHUs using a mezzanine on the top of the roof; Figure 7-7 shows the proposed mechanical space configuration.

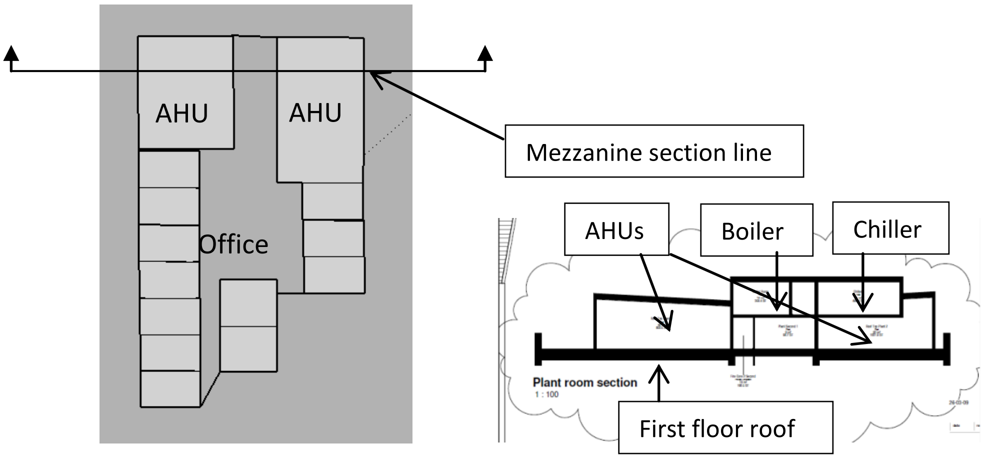


Figure 7-7 Second floor and roof plan / Section of the mechanical space using a mezzanine[59]

However, the idea to construct a roof mezzanine was abandoned for two reasons. First, the services engineers opposed the architects' proposal based on their desire for easy access to the AHUs, as they assumed replacing or servicing these AHUs would be difficult if they were located on the lower level of a mezzanine. Second, the proposal would be likely to conflict with the architectural design criteria, which stipulated that the building height was to be kept uniform with the surrounding structures (Architects report, March 2009). In addition, after calculating the required head heights of the mechanical space equipment, the services engineers determined that the AHU required 3.5m, and the boiler room required 3m. This meant that a minimum mezzanine height would be 6.5m, which was too tall to meet the project's height restrictions.

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[58] The figure on the left was a part of the architectural drawing, and the figure on the left was created by the author to simplify the image of the building in order to maintain the confidentiality..

[59] The figure on the left was drawn by the author to simplify the floor plan, while the figure on the right is a section of the architectural floor plan.

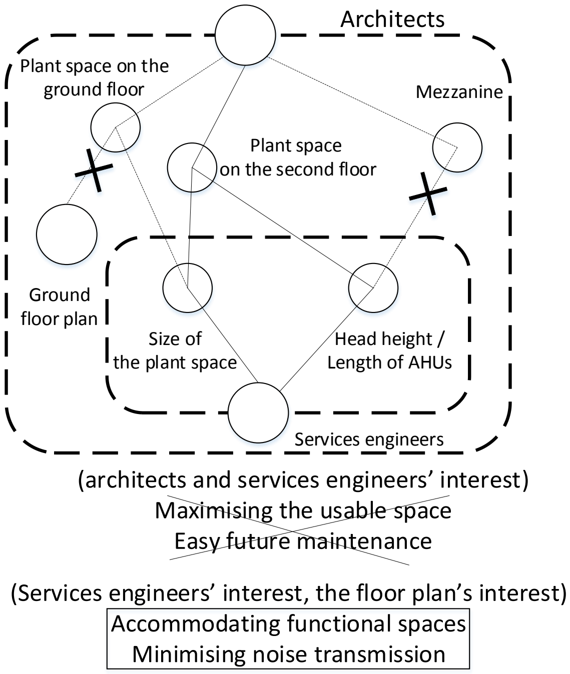

Figure 7-8 Architects' problematization of the mechanical space location

To summarise, the architects and the services engineers proposed several options for the mechanical space location, most of which were not adopted (Figure 7-8). First, the ground floor plan could not accommodate the mechanical space (represented by the dotted line on the left), because functional spaces already occupied most of the ground floor space. Second, the architects proposed constructing a mezzanine on the roof to house HVAC equipment and systems. However, the services engineers opposed this proposal based on the product information regarding the necessary head heights and their interest in future maintenance of the AHUs (the dotted line on the right). Also, the proposal conflicted with the height criteria. In the end, the architects located all mechanical equipment on the roof, which aligned with the services engineers' interests (the smaller rectangle). As a result, the mechanical space was located on the roof surrounding the second floor, covering most of the building area. With this solution, the ground floor could accommodate the requisite functional spaces, the services engineers could easily access the HVAC systems, and the height criteria could be met. However, this option did not satisfy the architects' interests in maximising the usable space on the second floor and the services engineers' desire to minimise noise transmission from the mechanical space.

7.3.2 Second floor office design

After the proposal of constructing a mezzanine was abandoned, the mechanical space equipment occupied nearly all the roof area. As a result, the size and the layout of the second floor office spaces changed. Figure 7-9 shows the changes made to the office space layout before and after the selection of the standard ventilation system.

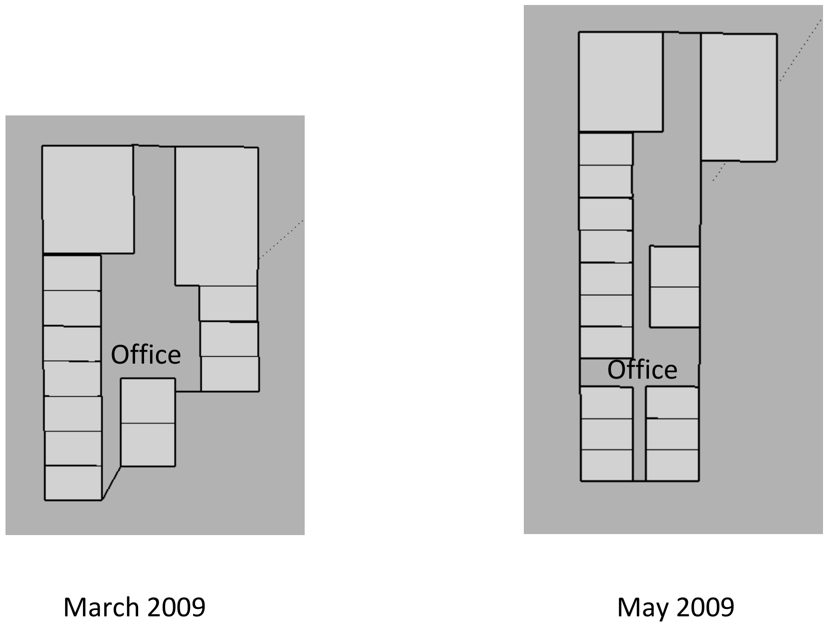

Figure 7-9 Change in the layout of office space from March to May 2009 (drawn by the author)

In March 2009, prior to determining the ventilation system, the floor plan showed individual academic offices surrounding a void (Figure 7-9, left). However, as the size of the mechanical space increased, the plan was unable to accommodate this void. As a result, the May 2009 plan arranged the offices in straight lines divided into two groups of six and eight rooms, respectively, with stairs in between (Figure 7-9, right). Although the number of academic offices remained at 14, office areas were reduced from 15m^2 to 12m^2. Furthermore, at a cost reduction meeting in May 2009, the project team proposed that the size of the offices should be further reduced from $12m^2$ to $11m^2$. As a result, the SFD's interest in larger size of each office room was moderated.

After the project team members decided to reduce the office sizes, the architect proposed a larger shared faculty office space as an alternative to individual offices. The architects were interested in enhancing staff integration and in making the office space more open. However, the SFD insisted on maintaining individual offices:

> …we tried to change [the offices], but [the SFD representative] refused...that was the one thing about which the SFD representative was not flexible. She said we must have individual rooms because my guys need to… write lots…what we suggested was that the academics might actually want to be more integrated in the building
>
> (Lead architect interview, June 2013)

This statement suggests the SFD representative's interest in the privacy afforded by individual offices. As a result of keeping the individual offices, the SFD's interest in privacy was prioritized over the architects' idea to construct a single open plan office space. However, as a result of the reduction in the second floor area, the SFD's interest in larger offices was not incorporated.

Significantly, the SFD representative did not recognize the affect of its earlier ventilation system selection on decision regarding standard faculty office size and layout, because the interdependence of the decisions on the ventilation system and the office space was not communicated at the first place. When the ventilation system was under consideration, the services engineers outlined several options, but their presentation did not clearly communicate the impact this choice would have on the size of the mechanical space. As a result, the floor plans necessitated a change in the size of the mechanical space, and, by extension, the offices. For the first time, this plan showed an increase in mechanical space area and a decrease in the office sizes. In other words, the lag between these two documents, which were produced at different times, resulted in miscommunication of the interdependence between these two concerns.

7.3.3 Boiler and chiller location

Next, the architects considered precisely where to locate the mechanical space and its AHUs, boiler and chiller, as a number of fixed decisions and mechanical requirements limited the available options. First, the office spaces occupied the southwest side of the building, so the mechanical space was shifted to the northeast side of the roof. Second, the required length of the AHUs limited their arrangement, and as a result they were placed on the eastern side of the roof, with the boiler and chiller on the northern side (See Figure 7-10). Finally, the architects had to decide if the boiler or the chiller should be located above the TV studio. They proposed to place the boiler room above the TV studio and the chiller above Theatre 2, based on their assumption that the SFD was interested in the higher soundproofing levels for the studio than Theatre 2[60], and the chiller was likely to produce more noise and vibration. Figure 7-10 shows the options for locating the boiler and chiller either above Theatre 2 or the TV studio.

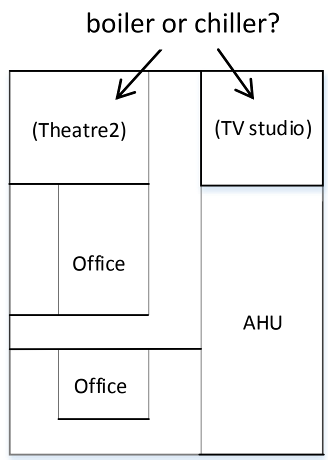

Figure 7-10 Options for the location of the boiler and chiller (drawn by the author)

The architects located the boiler and chiller based on their assumptions of the SFD's interests. However, this proposal was further restricted by mechanical requirements and various other

[60] The reason for the SFD representative's interest in elevated soundproofing levels for the TV studio is explained in Section 7.4.2.

constraints, including the length of the AHUs and the area and location of the office spaces on the plan. Thus, the locations of the boiler and chiller were not based on any single actor's interests:

> …the reason for putting the boiler on that side of the room was because … there were the chiller units, on the other side, which would have had more on the acoustic vibration problem onto the TV [studio].... A bit of a Rubic's cube of… just trying to get everything to work.
>
> (Lead architect interview, June 2013)

This statement suggests the architects' attempt to propose a solution in line with the constraints of other fixed decisions and mechanical requirements, as opposed to incorporating particular actors' interests.

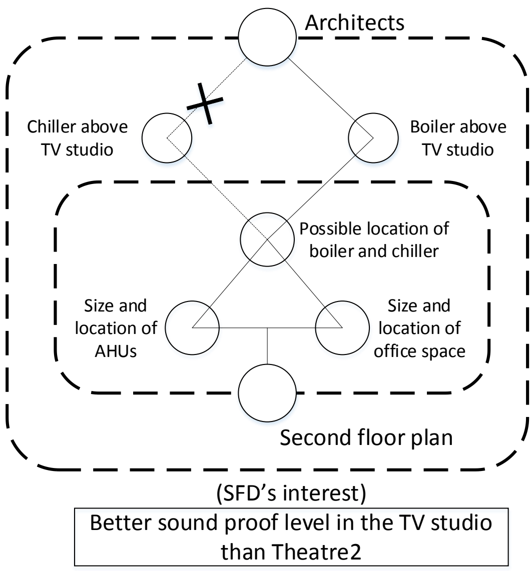

Figure 7-11 Architect problematization of boiler and chiller locations

To summarise, the architects proposed the location of the boiler and chiller under the constraints of the fixed locations of the second floor plan (Figure 7-11). This plan limited the possible boiler and chiller locations due to the size and location of the office spaces and the AHUs (represented by solid lines within the smaller rectangle). Based on this plan, the architects proposed to place the boiler above the TV studio (dotted line) because of the SFD's interest in higher soundproofing levels for the studio.

In this section, fixed decisions and mechanical requirements limited the options for subsequent decisions with respect to three issues: 1) the mechanical space location, 2) the size and layout of the office spaces, and 3) the placement of the boiler and chiller. First, the performance spaces were fixed on the ground floor plan, which limited the options for locating the mechanical space. In addition, the services engineers opposed the architects' suggestion to construct a roof mezzanine based on the height requirements of the mechanical space and the services engineers' interest in maintenance accessibility. As a result, the mechanical space encompassed nearly all of the building area surrounding the second floor. Second, the decision regarding mechanical space size limited the options for the area and layout of the offices. Third, the size of the office spaces and the length of the AHUs limited the possibilities for locating the boiler and chiller, which were placed on the northern side of the roof. In the end, the SFD's interest in elevated soundproofing levels for the TV studio was incorporated into the decision to locate the boiler room above the studio. However, the SFD's interest in elevated sound proofing level in Theatre 2 and TV studio was compromised in comparison with the previously proposed but rejected solutions such as setting up the mezzanine and locating the chiller on the ground floor. These solutions would have isolated chiller from either Theatre 2 or TV studio, and thus, minimise potential noise transmission to these spaces.

Throughout this process, the proposed size and location of the mechanical space changed. Figure 7-12 shows the size and location changes of mechanical systems and of the second floor space in the development of the floor plan between March and October 2009 Initially, before the standard system was selected, the services engineers assumed the mechanical space would be smaller. On the March 2009 architectural floor plans, most of the mechanical equipment was located on the northern side of the roof area before the standard ventilation system was chosen (Figure 7-12 left). However, after the size of the mechanical space significantly increased, the architects suggested constructing a roof mezzanine to house all the mechanical systems in the limited building area, by housing the chiller and the boiler above the AHUs. This proposal located all the mechanical space on the northern side of the roof area, and was presented in the April 2009 architectural floor plans

(Figure 7-12 middle). As a result of abandoning the idea of the mezzanine , the area of the mechanical space was significantly increased, and by October 2009 it was planned to cover most of the building area surrounding the second floor space.

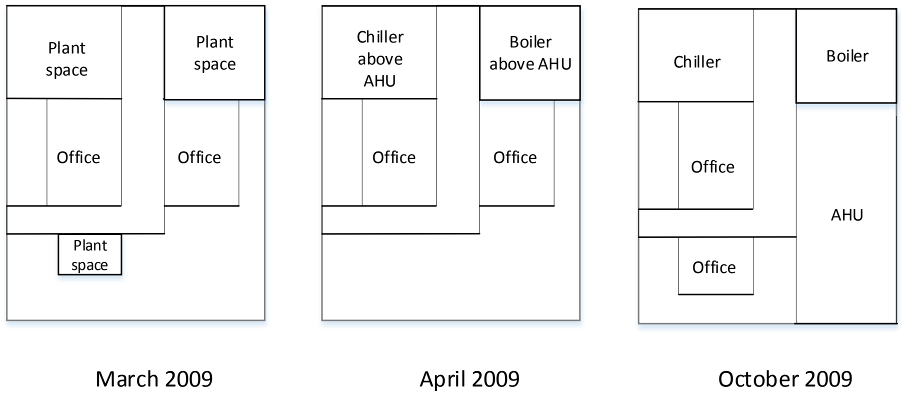

Figure 7-12 Changes in the size and location of mechanical space from March to October 2009

7.4 Acoustic design of the mechanical space floor

The acoustic design of the floor of the mechanical space was discussed throughout the detailed design stage. This section analyses three issues that relate to challenges surrounding the acoustic design. First, the project team members discussed consulting an acoustician. Second, the acoustician advised the acoustic design of the mechanical space floor. Third, locating the mechanical space above the performance spaces influenced the project contract. In addition, during the building occupancy stage, a faulty pipe fitting resulted in a leak in the mechanical space. This discussion was influenced by the timing of various actors' involvement in the project, the emergence of their interests and proposals, and decisions that became increasingly fixed over time.

7.4.1 Consulting an acoustician

At several points in the design process, the project team proposed consulting an acoustician. At various times, based on various University members' interests, the PM either accepted or rejected this request.

The project team first discussed consulting an acoustician at the concept design stage. In August 2008, in their initial statement, the services engineers recommended the early appointment of an acoustician, as various performance spaces in the building required soundproofing. As a result, the SFD representative agreed to hire an acoustician. However, the external PM commented that this would occur following the concept stage:

> We intend to appoint an acoustic consultant to advise on these issues during the next stage after feasibility. I think for the most part this guidance will need to be followed.
>
> (External PM comment, August 2008)

This statement suggests the PM's intention to consult an acoustician during the detailed design stage, based on University guidance on the procurement strategy.

The acoustician was first involved in the project in March 2009, at the beginning of the detailed design stage. In April 2009, he reviewed the architectural plans, and produced a report in June 2009 that set the acoustic criteria for each functional space and recommended the design of walls, floors, doors and stairwells with respect to acoustic features. However, unlike the ongoing involvement of other project members, such as the architects and the services and structural engineers, the acoustician's work was temporary.

In September 2009, during a design team meeting, the project team proposed to further involve the acoustician. The architects were particularly interested in ensuring that their designs for wall and floor systems would meet acoustic criteria. As a result, in October 2009 the project team decided to consult the acoustician for an additional two meetings. The PM implied the reason for the intermittent involvement of the acoustician in an interview regarding the appointment of project specialists in general:

> … this is where you agree… and it's not the BBC, it's a teaching facilities, so… sort of compromise… and … it's the architects ensure as much as possible that the materials are correct, and masses are correct, and that sort of thing…
>
> (Internal PM[61] interview, April 2013).

This quote suggests the PM's decision regarding the intermittent involvement of the acoustician was based on his assumption that the SFD required soundproofing at a standard sufficient for teaching purposes, not for professional performance spaces. Also, the PM assumed that the architects were responsible for acoustic design specifications.

In December 2009, after the acoustician participated in the two additional meetings, the architects again requested his services, specifically for advice on the reverberation time control, or the level of acoustic absorption, for the performance spaces (Design team meeting minutes, December 2009). The architects' suggestion was based on their interest in creating performance spaces to suit a variety of purposes, including musical and spoken word performances (Support architect interview, June 2013). However, the PM did not accept this request. According to the architects, this decision against further involvement by the acoustician was based on reducing costs:

> … the continuity of having him had stopped until finished, it's all down to money, I think, how much they have to pay… because it [the cost of involving an the acoustic specialist is] fairly high…
>
> (Architectural technician interview, June 2013)

During the interview, the PM did not directly refer to his interest in reducing costs. However, he stated: "I think we might have an acoustician, as another someone else to pay" (Internal PM interview, April 2013). This quote implies his perspective on the appointment of specialists as extra cost from the limited budget. In the end, the architects decided that they could continue the design without consultation on the reverberation time control design (Design team meeting minutes, January 2010).

[61] This account was in reference to discussing the appointment and coordination of specialists in general. In fact, the PM did not clearly remember involving an acoustician in this project.

This analysis discusses the PM's response to requests to consult an acoustician at various points in the project. The PM either accepted or rejected the project team members' suggestions based on a number of interests, including following University policy, his assumptions regarding the SFD's interests and the architects' responsibilities, and deferring the cost of consulting an acoustician. However, the PM's decision to only intermittently involve the acoustician eventually influenced the acoustic design of the project.

7.4.2 Noise rating levels for each functional space

When the acoustician was first consulted in April 2009, he proposed design criteria for each space, as acceptable sound levels varied by use. He used the noise rating (NR) level[62] to guide these criteria, and the PM and the SFD representative accepted them. As stated above, SFD required soundproofing levels appropriate for teaching facilities, as opposed to professional facilities:

> … we didn't need… tip-top professional quality … we wanted it to be sort of like down here [indicating a certain height with his hand]… whereas in the previous facilities down here somewhere [indicating the lower height with his hand]… some kind of compromise, and that was always the kind of way we talked about it.
>
> (SFD Head interview, April 2013)

The quote suggests the SFD's interest in higher soundproofing levels than those of its existing facilities, and the new criteria were established to outperform these facilities. In particular, the SFD required the highest soundproofing (i.e. the lowest NR level) for the TV studio, because particularly sensitive recording equipment was used there. The SFD had experienced difficulty with recording in its existing studio, where microphones routinely captured ambient noise, including the sound of rain on the building roof (Internal PM interview, April 2013). As a result of this discussion, the acoustician proposed to set the NR level for the TV studio at 20, the theatres and screening room at NR 25, and individual offices at NR 30.

[62] The term *noise rating* (NR) refers to "the maximum acceptable level in each octave band of a frequency spectrum, or to assess the acceptability of a noise spectrum for a particular application" (Technical Committee B/209 1999). In terms of this metric, the lower the NR level, the higher the level of soundproofing.

However, the project team members were not convinced of the feasibility of meeting an NR level of 20 for the studio. The May 2009 design meeting minutes stated that "the NR 20 requirement for the TV studio[63] is a concern for the mechanical space; there was some doubt expressed about the need for this" (May 2009). As this indicates, an ongoing discussion about the studio's NR level was held throughout the detailed design phase.

By contrast, another of the SFD's interests in the soundproofing levels of the sound workshop unexpectedly emerged at the occupancy stage, as the SFD was not satisfied with its existing soundproof level. As with the TV studio, this space was used to edit sound for film and theatre recordings, but in a much smaller space. After the building was finished, the SFD's technicians improved the soundproofing levels of the workshop, installing additional sound dampening equipment (the SFD representative interview, July 2013).

This analysis highlights the gap between the project team members' assumption of the SFD's interests during the project and the SFD's actual interests, which emerged only after the project was completed. The project team held an ongoing discussion about the NR level of the TV studio based on their assumption of the SFD's interest in this space. However, throughout the project, the SFD was only interested in improving the soundproofing levels over those of the existing facilities[64]. In addition, the SFD's other interest in increasing the soundproofing levels of the sound workshop emerged only after the completion of the building.

7.4.3 A change in the acoustician's proposed design

The acoustician first reviewed the architectural plans in April 2009, and learned that the mechanical space was located above acoustically-sensitive performance spaces. As a result, the acoustician proposed to design the mechanical space's floor system as "reinforced screed decks on top of a

[63] In his interview, the services engineer stated that achieving NR 20 for the TV studio was not feasible. Available data are inconclusive as to whether or not the project team members eventually changed the NR level for this space.
[64] During the interview, the SFD representative was not familiar with the term "NR level".

resilient membrane, with no structural connections to the base roof slab below" (Acoustician report, June 2009). This recommendation was based on minimising any potential noise transmission from the mechanical space to the performance spaces.

The acoustician's second term with the project occurred after the project team decided to place the boiler room above the TV studio. This time, the acoustician paid particular attention to the boiler location, and pointed out in his review this configuration risked the possibility of a flanking path, or the effect of sound moving from one space to another through direct and indirect pathways. According to the design drawings, four drainage pipes would penetrate the floor system below the boiler room, potentially bridging the floor system and most likely transmitting sound from the boiler room to the studio below. As a result, he proposed changing the boiler room location to minimise this risk. However, the architects maintained they were unable to change the boiler room location at that time:

> Yeah, we were told very early on that no drainage was to pass into any of these zones and I think, above the TV studio, it did… and we told we couldn't move it.
>
> (Architectural technician interview, June 2013)

This statement suggests that the rejection of the acoustician's proposal was not based on the architects' own interests. Instead, the floor plan, in effect, "rejected" the acoustician's suggested change. In other words, a number of design decisions were fixed on these plans, such as placing the mechanical space on the roof, the area and location of the office spaces, and the size and length of the AHUs. A change in the location of the mechanical space would require a change in the entire configuration of the floor plan, which was not possible at that stage in the project.

In the end, the acoustician accepted the boiler room location and that drainage pipes would penetrate the floor system above the TV studio (Acoustician report, October 2009). As a result, he proposed to treat the drainage pipes and brackets to make them "acoustically lagged with a mineral fibre" and "wrapped over and clad with a sound barrier mat". Also, he recommended that the pipes should be "isolated via oversized brackets with neoprene inserts" (Acoustician report, October 2009).

His proposal was based on his interest in minimising noise transmission to the studio, and he stated that these recommendations constituted a high level of treatment. However, he also warned that the risk of sound leakage would remain, which suggests that his proposal was a compromise that only partly reflected his interests.

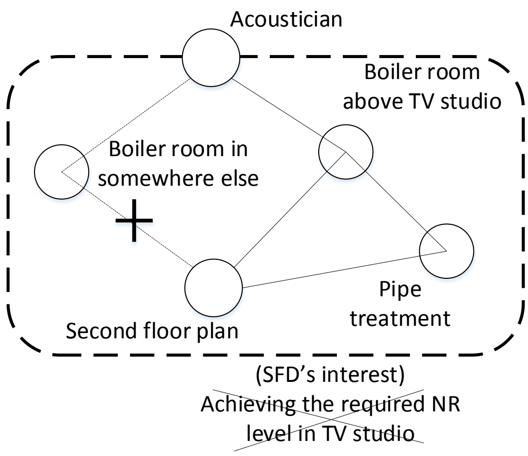

Figure 7-13 Acoustician's problematization of the acoustic design of the boiler room floor

To summarise, based on the constraint of the boiler room location, the acoustician proposed to acoustically treat the boiler room floor (Figure 7-13). Based on the necessity of maintaining the area and location of the AHUs and the office spaces, the design of the second floor mechanical space could not accommodate a change in boiler room location (represented by the dotted line). As a result, based on his interest in minimising noise transmission to the TV studio, the acoustician accepted that the boiler room would be placed above the studio but proposed to acoustically treat its drainage pipes. However, the incorporation of the SFD's interests in the elevated soundproofing levels for the studio was compromised compared with the previously proposed but rejected proposal, changing the boiler room location.

This analysis highlights the effects of the timing of the acoustician's involvement and the development of the project's architectural plans. When the acoustician was involved the second time, the floor plans were unable to accommodate the acoustician's proposal to change the boiler room location, because the area and location of the mechanical space had already been determined.

Such decisions were fixed in a series of documents, including the services engineers' area schedule, the architects' plans and the services engineers' drawings, which had been developed before the acoustician's second consultation.

7.4.4 Effects of situating the mechanical space

The decision to locate the mechanical space above the performance spaces changed the contractual arrangement between the University and the contractor and caused an unexpected incident at the occupancy stage. In April 2010, when the contractor joined the project, he proposed in his contract to assign the responsibility of designing the building's acoustics to the architects and the University, because he did not want to guarantee the required soundproofing levels for the performance spaces. The internal PM accepted the contractor's proposal, as he understood the difficulty in meeting the acoustic criteria under the parameters of the current performance space locations:

> … You could say to the contractor, it will be 3db… and if it's not, well you make sure that it's 3db, and we've already paid you, and this is what I'm buying, and I don't think we played that game… it's difficult… and they were resistant to that, they made sure that they can push the risk back onto the designer and the client.
>
> (Internal PM interview, April 2013)

> … even though we had worked up a really good acoustic solution… it wasn't an obligation we had to totally fulfil… both people know there was some risk there… depends on what you ask for the contract… if you put some too over spec that's impossible… you take a risk… we don't bear to do it, and sign the contract…
>
> (Contractor interview, September 2013).

This statement underscores the contractor's perspective on including the achievement of the acoustic criteria in the contract as "over specification", which suggests he wanted to avoid responsibility for meeting unrealistically specific acoustic requirements.

Locating the mechanical space above the performance spaces also resulted in a situation that occurred after the building was occupied in April 2011. Three weeks after the building was handed over, the boiler leaked and water drained into the TV studio. The PM recalled that the result was "like rain from the ceiling" and that the water level reached "several inches deep". This leak was caused by a pipe failure in the boiler room; a pipe ring was not fitted properly, and the pipe exploded (Architectural technician interview, June 2013; Contractor interview, September 2013). In the end, the contractor replaced the faulty parts and attributed the problem to defective workmanship. However, the PM regarded this incident as "unfortunate", and not one that any particular project team members were responsible for:

> … [the] flooding was an unfortunate event…but not one we can necessarily penalize the architect for… the contractor said… please be mindful that you have put the plant [mechanical spaces] on the roof above the performance spaces…and we considered it, and probably did not give justice… having said that, we did look at tank in the room and… it wasn't seamless design criteria, but in hindsight, fantastic… through no consequence of the design, there was a defective part….
>
> (Internal PM interview, April 2013)

This statement illustrates the PM's treatment of the incident as an unfortunate occurrence beyond the responsibility of the project team. The PM also noted the contractor's concerns regarding positioning the mechanical space above the performance spaces. This location could not be changed when the contractor became involved[65], as this was just before the construction stage. The faulty ring connection became obvious only after the design specifications were fixed.

The timing of various actors' involvement in the project, the emergence of their interests, and project decisions made over time all influenced the incorporation of actors' interests with respect to the four issues discussed in this chapter: 1) the involvement of the acoustician, 2) the NR level for each space, 3) the change in the acoustic design of the mechanical space floor, and 4) the effects of the decision about the mechanical space location. In the first instance, at various points, the PM accepted or rejected requests to involve an acoustician based on a number of factors, including University guidance, SFD interests, the architects' responsibility and the PM's interest in reducing costs. The project team members' requests were accepted for the first and second time, but not the third. In the second instance, the project team members held an ongoing discussion about the NR level of the TV studio based on an assumption of the SFD's interest in the studio. However, the SFD's

[65] Although employed by the same company, the construction advisors involved during the design stage did not include the project manager involved in the construction stage.

interest in the soundproofing level of the workshop emerged at the occupancy stage, and because it did not call for as much attention as the TV studio this interest was not incorporated. Third, the acoustician proposed to change the boiler room location, which was rejected because the decision had already been fixed. Finally, the contractor sought to avoid assuming responsibility for acoustic standards, which were fixed by the time he became involved. Also, the faulty boiler drainage pipe connection was revealed only when the leak occurred at the occupancy stage.

7.5 Incorporation of actor interests into mechanical space decisions

Some actors' interests were incorporated over others in the decision-making process to determine the size and location of the mechanical space. Issues surrounding this process included the selection of the ventilation system for the performance spaces (Section 7.1), calculation of the mechanical space size and the design of service duct routes (Sections 7.2.1-7.2.3), determination of the mechanical space location (Sections 7.3.1-7.3.3) and the acoustic design of the mechanical space floor (Sections 7.4.1-7.4.4). Table 7-2 lists the actor interests that were incorporated (IN) and not incorporated (NIN) at each moment of this process.

Table 7-2 Incorporation of actor interests into the proposals about mechanical space size

	Proposal	Actors	Incorporation of actors' interests
7.1	SFD selection of standard ventilation system	SFD, services engineers	**IN:** (SFD) Flexible theatre production; (project team) Reducing costs **NIN:** (services engineers) energy efficiency
7.2.1	Services engineers' calculation of mechanical space size	SFD, services engineers	**IN:** (SFD) Thermal comfort in each space, Accommodating sufficient students in each space; (PM) Reducing additional temperature control costs
7.2.2	Coordination of structural beam design with duct routes	Architects, structural engineers	**IN:** (architects) Maximising available space for performance areas; (structural engineers) Simplified construction, Reducing costs
7.2.3	Aesthetic design of exposed ducts in the atrium	Architects, SFD	**IN:** (SFD) Aesthetics **NIN:** (architects) Aesthetics, Reduction in duct noise
7.3.1	Decision to locate mechanical space on the second floor	Services engineers, architectural floor plans	**IN:** (floor plans) Accommodating required areas of performance spaces on the ground floor (design criteria), Maintaining building height in line with surrounding structures **NIN:** (services engineers) Minimising noise reduction to building interior, Ease of mechanical space access, Maximising usable second floor space
7.3.2	Architects' proposed design of office space size and layout	SFD, architects	**IN:** (SFD) Academic staff privacy **NIN:** (architects) Opening the second floor plan, Integration of academic staff; (SFD) Larger office rooms
7.3.3	Architects' decision on boiler room location	Architects, floor plans	**IN:** (services engineers) Accommodating size and length of the AHUs; (SFD) Improved soundproofing in TV studio
7.4.1	PM's acceptance of intermittent involvement of acousticians	PM, architects, services engineers	**IN:** (PM) Eliminating costs of employing specialists (architects) Improved acoustic specifications **NIN:** (architects) Further design of reverberation times
7.4.2	SFD's agreement on acoustic criteria	The SFD, PM, acoustician	**IN:** (SFD) Improved soundproofing over existing facilities **NIN:** (SFD) Improved soundproofing in sound workshop (project team members) Achieving NR 20 in the TV studio
7.4.3	Acoustician's proposal of pipe treatments for boiler above TV studio	Architects' floor plan, acoustician	**IN:** (architect floor plans/ services engineer drawings) No additional changes in boiler room location **NIN:** (acousticians) Avoiding risk of flanking path in TV studio
7.4.4	Effects of decision regarding mechanical space location	PM, contractor	**IN:** (contractor) Avoiding responsibility to achieving acoustic levels **NIN:** (project team members) No defective parts

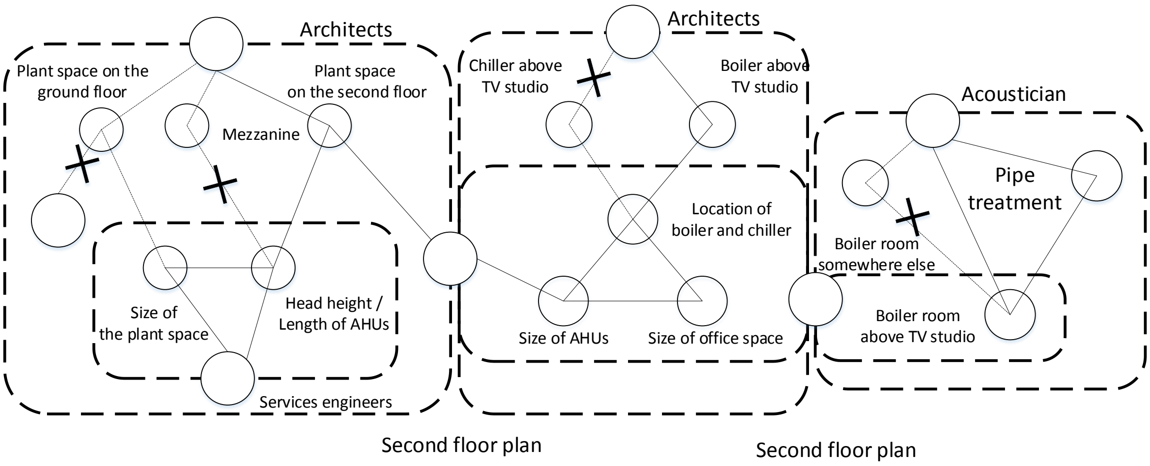

Figure 7-14 Actors' problematizations of option selection around mechanical space location

A number of different actors were involved in the course of this discussion, including University members (SFD, PM), project team members (services engineers, architects, structural engineers, acoustician, contractor), a number of documents (mechanical space size calculations, architectural floor plans, mechanical drawings) and building components (sound workshop, drainage pipes).

How some actors' interests were incorporated instead of others changed at each moment. For example, the SFD representative chose the standard ventilation system over the displacement system, incorporating their own interests over those of the services engineers (Section 7.1), and the SFD's, PM's, architects' and services engineers' interests were incorporated into the design of the service duct routes (Section 7.2.1-7.2.3). In addition, as new information became available and decisions were made, the available options for the mechanical space location narrowed (Section 7.3.1-7.3.3). Furthermore, the timing of different actors' involvement, the emergence of their interests and proposals, and the stabilization of decisions all influenced the incorporation of actor interests with respect to the acoustic design of the mechanical space floor (Section 7.4.1-7.4.4).

In particular, the discussion surrounding the mechanical space location (Section 7.3) involved a number of project team members and documents at discrete points, which complicated the incorporation of client interests. Figure 7-14 illustrates the architects' and the acoustician's problematizations at different moments with respect to the discussion of the mechanical space location.

As Figure 7-15 indicates, in the course of this decision-making process, the second floor plan developed over time, which in turn shaped and limited the incorporation of the SFD's interest in the NR levels of the performance spaces. Initially, the architects proposed locating the mechanical space on the roof, based on the floor plan's representation of functional spaces on the ground floor and the services engineers' mechanical space requirements and length of the AHUs. This suggestion led to compromise on the SFD's interest in the soundproofing level of the performance spaces. Then, the second floor plan fixed the size and location of the AHUs and office spaces, limiting the architects' options for locating the boiler and chiller. As a result, the architects proposed placing the boiler room above the TV studio, based on their assumption of the SFD's interest in the higher NR level of the TV studio than Theatre 2. However, this interest had been more securely incorporated in the previously proposed but rejected solutions; locating the mechanical space on either the ground floor or the roof mezzanine level. Finally, the second floor plan fixed the boiler room location above the TV studio, which rejected the acoustician's proposed change in boiler room location. The acoustician accepted this decision, and suggested the acoustic treatment of the associated pipes based on his interest in increasing the soundproofing level of the studio. However, the acoustician's desire for an increased NR level, which was in agreement with the SFD's interests, was again compromised, as it conflicted with his proposal to change the boiler room location.

The above analysis describes the incorporation of client interests in the absence of clients. Although the SFD was the client, it was not directly involved in the decision-making processes. Instead, the project team members proposed a solution based on their assumptions about the SFD's interests. Significantly, as the project developed, project documents led to limitations in available options or rejected proposals outright by fixing a number of decisions. This led to compromise with respect to the incorporation of the SFD's interests. More specifically, the conflict between the project team members' proposals and the options permitted by the project documents resulted in successive compromise in the incorporation of the SFD's interest in the elevated sound proofing level of the studio.

Throughout this process, the clients, project team members and material objects exercised different types of powers in the shifting configuration of actors, their interests and their proposals. For example, the clients had the power to select between alternative proposals, as the SFD elected the standard ventilation system over the displacement system (Section 7.1) and rejected the architects' proposal of a shared office space (Section 7.3.2). Similarly, the PM chose to set the maximum building temperature according to building regulations' minimum requirement instead of following the CIBSE guide (Section 7.2.1). In addition, the clients determined the timing of various actors' involvement. For example, the PM brought on the acoustician at a particular time (Section 7.4.1).

By contrast, the project team members had the ability to adjust the set of proposals within the constraints of fixed parameters. For example, the structural engineers were able to redesign the composite beam plan (Section 7.2.2) based on architects' interests, services engineers' decision and the structural engineers' interests at different times. In addition, the acoustician proposed the acoustic treatment of the boiler pipes, based on the decision to locate the mechanical space being above the performance spaces (Section 7.4.3). Also, the contractor proposed the contractual arrangement based on this decision (Section 7.4.4). In this way, the project team members tailored their proposals to fit the parameters in play at any particular moment.

Finally, material objects had the power to shape and constrain the project team members' proposals. For example, the services engineers' proposal to locate the chiller on the ground floor conflicted with the ground floor plan (Section 7.3.1). The second floor plan dictated the available area for the mechanical space, which limited the options for locating both the boiler and chiller (Section 7.3.3). In addition, the second floor plan did not provide for the acoustician's proposed change in the boiler room location (Section 7.4.3). Furthermore, some material objects involved in this process helped to sway particular actors' attention, leading to the emergence of specific interests. For example, the SFD's newfound interest in the elevated NR of the sound workshop first emerged when the SFD used this space (Section 7.4.2).

In this chapter, shifting power relations were analysed with respect to the dimensions and location of the building's mechanical space. The above analysis underscores the clients' power to accept or reject proposals, and the project team members' agency to propose or modify plans within project constraints. Also, by illustrating which decisions were fixed, material objects contributed to shaping or limiting project team members' proposals. Over time, as more project decisions were made, the relative ability of the clients to influence decisions was constrained, and the power of the project team members and project documents increased.

8 Discussion

The previous chapters traced a range of actor interests involved over the course of the University building project, and explored why some interests were incorporated whereas others were not. The findings provide insights into client engagement processes which influenced the incorporation of client interests. This, in turn, contributes to a discussion about multiple and shifting clients, their interests and the way clients imposed their interests, which changed over time in the course of the project.

8.1 Research analysis overview

The three topics of decision-making processes analysed for this building project include building location, space allocation and mechanical space size. The study of these topics explored the incorporation of different and shifting client expectations into the development of a building project. The analysis focused particularly on how actors persuaded each other to adopt solutions. It documented the way multiple and shifting actor interests were factored into a number of decisions, and revealed the incorporation of selective actors' interests in the project. This, in turn, is a basis to reflect on how clients imposed their interests in decision-making processes and thus, influence the way the project and the complete building were shaped. The discussion which follows reflects each of the research objectives. These objectives are:

1. To explore multiple and shifting actor expectations in the course of a project.
2. To examine how project participants' expectations are accommodated through their interactions
3. To analyse how clients impose their expectations over others among the range of actors

The research analysis traced client interests among a range of actor interests. A shifting configuration of actors, their interests, their proposals and the decisions that resulted from these proposals was documented surrounding a number of issues within a building project. This analysis documented the incorporation of client interests among the range of actor interests. It also allowed for the analysis of the impact of client engagement on the incorporation of client interests. In other words, it provided insights into how clients impose their interests over others. The exploration of these objectives provided a basis to address the main aim of this thesis, namely: to examine the way clients shape the development of a building project.

8.2 Multiple and shifting actor interests

In response to the research objective 1: To explore multiple and shifting actor expectations in the course of a project, this thesis applied ANT to trace the range of actors' dynamic negotiations and persuasions, in which multiple and shifting actor interests were traced in the course of a project. Actor interests were revealed which include those of clients, project team members and material objects, which influenced each other.

8.2.1 Different and changing client interests

The three topics analysed in this research spanned different project stages, from the initial feasibility study to the final building occupancy phase. The analysis documented a number of clients' engagement in decision-making processes at different times during the project. The main clients (i.e. the University members) included: 1) the School of Film and Drama (SFD) members, 2) the Head of Space Management (HoSM), 3) the Board of Governance (BG), 4) the other feasibility group (FG) members and 5) the project managers (PMs). In this analysis, both the internal and external PMs were classified as clients, as they both made decisions and responded to project team members independently on behalf of University members. This suggests that, for the ANT framework of this thesis, whether or not PMs are classified as clients depends on the nature of the project or issues, and more specifically, if clients and project team members regard them as client representatives in decision-making processes.

The analysis traced the interests of the client organization (i.e. the whole University), the clients' groups (e.g. SFD, BG, and FG) as well as client team members (HoSM, PM, DF, SFD Head). For example, during a discussion about building location decision, the FG members (a group) were interested in maintaining the green space open, whereas the Dean of the Faculty was interested in academic integration between the SFD and another department. This analysis expands on the studies of client engagement in the course of a project which tend to focus on either organizational procedures (Connaughton1993) or individual behaviours (Thomson 2009) to analyse client goals and requirements. Instead, it follows Hedgren and Stehn's (2013) attempt to examine both organizational procedures and individual behaviours of dynamic client engagement in decision-making processes, and further studied specific client goals and requirements in the course of a project.

More specifically, the analysis traced multiple client interests which were at play in the project, and clients with various interests were involved at different times. For example, University administrators participated in the final stages of the concept design workshop and their interest in campus legibility emerged regarding the design of the building entrance (Section 6.3). This "client interest" differed from another "client interest", namely the SFD representative's interest. the SFD representative had been involved throughout the concept design, and was concerned with the use of theatres and informal rehearsal spaces, as opposed to the administrators' interest in campus legibility. At times even single actors showed multiple interests in different issues. For example, the Head of School for the SFD was generally interested in the function of spaces, such as flexibility of theatres and the acoustic quality, but was also personally invested in the aesthetic design of the atrium ducts (Section 7.2).

Moreover, client interests were analysed even in the absence of clients. Throughout the project, some client interests were advanced by representatives at moments when the other clients were only indirectly involved. Specifically, client representatives acted as spokespersons for clients, due to a lack of specific knowledge, experience or interest. For example, the PM accepted the acoustician's proposal to change the NR level of Theatre 1 on behalf of the SFD, due to the SFD's lack of construction knowledge (Section 6.4). In addition, the Vice Chancellor chose the car park site as the building location on behalf of the other BG members because of their perceived lack of interest in this issue. In short, client members who were directly involved in the project sometimes advocated for their preferences and imposed their interests on behalf of other members.

Even project team members often advocated for client interests. For example, the master plan architect assumed that the University was invested in drawing visitors to the centre of campus so that it could support the architect's recommendation of the east site (Section 5.1). Also, project team members advocated for clients in proposing solutions for technical issues. For example, the services engineers set the acceptable temperature range for each space (Section 7.2), and the acoustician set the NR level of each performance area (Section 7.4). However, because these decisions were presented as tables and figures, they were often beyond the SFD's understanding, even though the project team members regarded them as client requirements. This observation adds to Winch, Usmani and Edkins's (1998), who argue that gaps are likely to emerge between client expectations for as-planned and as-built facilities. While the authors presume that such gaps are managed through qualitative management methods, this thesis observed how these gaps emerge in the way project team members ascribe client interests in their proposed solutions. In the example illustrated above, client interests in the sound proof levels projected by project team members were beyond clients' understanding, which is likely to cause the gap between client expectations for as-planned and as-built facilities.

8.2.2 Client interests during multiple actors' interactions

During interactions with project team members, the multiple client interests changed over time, often in response to other actors' proposals and their interests regarding particular issues. For example, the FG members changed their stance on the building location after the public's interests became clear (Section 5.3). Similarly, the SFD became interested in informal rehearsal space in response to the architects' proposal (Section 6.1). This observation is in line with Luck (2007) and Alvesson *et al.* (2009), who documented the way client expectations emerge and change under the influence of consultants. The thesis expanded on this approach and further studied the range of actors' influence on changing client expectations in the course of the project.

Throughout the building project process, project team members also exhibited multiple and shifting interests independent from the clients. Project team members often specified or modified proposed solutions to accommodate client interests as well as their own interests. For example, the architects proposed placing building windows based on their desire to enliven the building exterior, which conflicted with the SFD's preference for windowless performance spaces (Section 6.2). In another example, based on the architects' and acoustic engineer's concerns, the structural engineers changed the floor design from metal-decked concrete to a pre-cast and in-situ concrete system (Section 6.4). In these examples, the project team members accommodated a number of actor interests in their proposed solutions.

Furthermore, the "interests" of material objects were also analysed. These interests held by material objects may conflict with client interests. For example, the floor plans could not accommodate the acoustician's proposal to change the boiler room location, which was based on client interests in better sound proofing level, and thus upheld their "interest" in retaining the building's spatial configuration (Section 7.4). In addition, material objects influenced client interests; some interests emerged only after the project was completed and the building was occupied. For example, the SFD's desire for teaching space in the building and the elevated soundproofing level of the sound workshop emerged only after project completion (Section 5.4; Section 7.4). This observation also adds to Winch, Usmani and Edkins's (1998) argument about the gaps between client expectations for as-planned and as-built facilities. This thesis reveals that new client interests often emerge in interactions with a completed building, which can cause a gap between client expectations during a project and those which emerge after a project.

As illustrated above, multiple and shifting actor interests were involved in this project, and as a result, actor interests were selectively incorporated into final project decisions. The analysis of this process provided insight into the range of actors' relative ability to impose their interests over others in decision-making processes.

8.3 Dynamic decision-making processes

In response to the research objective 2: "to examine how project participants' expectations are accommodated through their interactions", this thesis documented discussions and negotiation processes which resulted in project decisions, and thus, some actor interests were incorporated whereas others were not. The analysis illustrated changing project decisions, dynamic client engagement and shifting power relations between clients, project team members and material objects.

8.3.1 Changing project decisions

The thesis documented the way project decisions changed through successive discussions and negotiations among the range of actors. This is in line with Connaughton (1993) and Tryggestad *et al.* (2010) who particularly illustrated changes in project goals. However, in contrast to Connaughton's (1993) approach to examine clients' resource allocation and investment decision-making processes, this thesis particularly analysed the way actors persuade each other based on their own expectations. The thesis builds on Tryggestad *et al.* (2010), who studied the way design ambitions emerged and influence project goals, and further elaborated the analysis of actor interests, which are analysed as constituents of actors' proposed solutions or those which emerged in response to other actors' proposed solutions.

The analysis of actor interests revealed a variety of the ways in which project goals changed. For example, the building location decision was influenced by external actors, the public's interest. The University members changed their preferred option from the East site to the car park space because they presumed that the public preferred the car park space option after the public consultation. Interestingly, the project budget decision also successively changed as the design development. The BG members decided to double the project budget taking into consideration the SFD's interest ascribed by the PM in his recommended choice from options, which became clear as the design developed. Also, the BG's own interest in other potential projects in campus influenced the decision. Finally, the space allocation decision changed being influenced by a change in the budget as well as the SFD's original requirement. The project budget was less than what the developed space allocation wholly required, and resulted in the architects' new proposal of reducing the building footprint. The new proposal included the loss of the informal rehearsal space and a decrease in the atrium space size. This proposal, however, was associated with the creation of the break-out space and thus, still accommodated the SFD's interest in informal spaces, which was the SFD's original requirement. In this way, the decision changed under the budget restriction and the SFD's requirements ascribed by the project team members who proposed a new solution.

8.3.2 Dynamic client engagement in decision-making processes

Through the involvement in decision-making processes, clients shaped the range of options, chose from these options, and either accepted or rejected proposals. Dynamic clients' engagement in decision-making processes among the range of actors was analysed as available options became more constrained as the project developed. This analysis of dynamic client engagement is in contrast to Hedgren and Stehn (2013) who assessed the types of client engagement process as rational, judgements and managing multiple meanings in different sub-processes of a decision-making process of industrialized building projects. While the authors pay attention to dynamic client engagement, they do not take into consideration other actors' engagement and their influence on client engagement processes.

The clients shaped the range of options and selected their preferences in accordance with their interests. For example, the HoSM proposed building locations on the east and the west sides of the Purbeck Building based on her interest in maximising the use of existing space (Section 5.1). In some cases, client interests conflicted, which led to the adoption of some interests over others. For example, when discussing the building location, the FG members chose the car park site over the east site, which was supported by the Dean of the Faculty, based on their communication with the Vice Chancellor and the public's preference (Section 5.3) As these examples illustrate, this thesis studied clients' prioritization and comparison between different clients, their requirements and their preferred design options in line with Karma *et al.* (2000). The thesis goes beyond the linear process proposed by the authors, and documented the way the range of actors, their interests and their preferred solutions circularly influenced each other in the course of a project.

However, as the project developed, clients became more likely to either accept or reject project team members' proposed solutions. For example, the SFD rejected the architects' proposal of a shared office space based on its interest in faculty privacy (Section 7.3). Particularly, when interdependencies between issues were introduced, the project team members gained more power to persuade the clients to compromise on some of their preferred solutions. For example, the architects proposed the relocation of Theatre 1 based on their desire to make the ground floor more open despite the SFD's resistance, which drove the creation of the shared storage space between Theatres 2 and 3, thereby fulfilling the SFD's demand for flexible theatre use. As a result, the SFD accepted this proposal, resulting in the incorporation of the SFD's interests in Theatres 2 and 3, but not Theatre 1.

8.3.3 The shifting power relations between the range of actors

One of the main finding of this thesis concerns changes in the way actors imposed their interests throughout the design and construction process as the range of options became increasingly more constrained over time. Initially, clients shaped the range of options and made decisions on particular issues. However, later on the project team members specified or modified their preferences as they were far more constrained by the interdependence between issues. As more decisions became fixed on project documents, clients and project team members sought to change existing decisions or compromise on their preferences as their power to shape the options became increasingly limited.

Newcombe (2003) proposed a static model for understanding diverse stakeholders' likeliness to impose their interests. He analysed actors' power with an aim to avoid likely conflicts. In contrast to his study, this thesis particularly examined actors' choice from proposed solutions and analysed how particular actors imposed their interests over others through persuasions and negotiations. By doing so, actors' ability to impose their interests, which is defined as "power", was analysed as a result of actors' interactions. This concept of power, in turn, is central in the analysis of dynamic client engagement and its impact on the incorporation of their interests.

The shifting power relations are observed at three stages. Initially, with respect to certain issues, clients and project team members were presented with a range of viable solutions and chose options based on their own preferences. For example, when discussing the building location, the FG members chose the car park site over the east site, which was supported by the Dean of the Faculty, based on their communication with the Vice Chancellor and the public (Section 5.3). In another example, regarding the beam design, the structural engineers chose the pre-cast and in-situ concrete system over metal decked composite concrete option based on the architects' and the acoustician's concerns (Section 6.4).

To support their preferences, actors at times leveraged various policies, product information, components and project documents. For example, the HoSM proposed the shared use of the Purbeck Building by invoking the University's space management policy (Section 5.4). Also, the structural engineers chose structural assembled components to propose beam design (Section 6.4), and the contractor used the PM's email to change supplier's delivery date. Furthermore, actors used project documents as tools of persuasion. For example, the architects presented their concept sketch to persuade the SFD to support their design (Section 6.1). Similarly, the campus master plan development team presented the proposed SFD building location on its campus map to persuade the public to accept their proposal. However, in this case, the campus map unexpectedly drew the public's attention to the green space, which resulted in their opposition to the location (Section 5.3). As this final example illustrates, actors' persuasion strategies may or may not be successful.

Secondly, over time, as interdependencies between project issues solidified, available options for each issue became increasingly constrained and thus, project team members mobilized different concerns to specify or modify their proposals. For example, the architects proposed the single-storey height of Theatre 1 based on their interest in making the ground floor more open, prioritizing the issue of accommodating the required functional spaces over that of keeping the double-storey height of the theatre (Section 6.2). In another instance, the architects proposed including windows in the spiral staircase spaces based on their desire to enliven the building exterior, combining this issue with that of performance space access to control rooms (Section 6.2).

To support proposals which involve interdependencies, project documents were often used to facilitate actors' understanding of the interdependence between project issues. For example, the floor plans were used to facilitate the SFD's comprehension of the interdependence between the sizes of the storage spaces and the dressing rooms, leading the SFD representative to propose to increase the area of the former and a decrease the latter. In contrast, the services engineers did not successfully communicate the interdependence between issues in their appraisal of the ventilation system; the SFD chose the standard system without fully understanding the affect this decision would have on the office space layout. As a result, the architects' floor plans, which were produced later, showed participants for the first time that an increase in the size of the mechanical space resulted in a decrease in office area. This example illustrates the impact of documents, whether they showed proposals for different issues separately or in concert, on project participants' understanding of the interdependence of certain issues. In other words, throughout the project process, various documents at times influenced the understanding of the consequences of incorporating some actor interests.

Finally, over the course of the project, decisions were successively fixed at different times. For some concerns, actors sought to change fixed decisions or compromise on their proposals as earlier decisions circumscribed or conflicted with their preferred outcome yet to be determined. For example, the BG members announced a budgetary decision that necessitated a change in the architects' earlier space allocation decisions. In another example, the architectural floor plans fixed decisions with respect to locating the mechanical space, resulting in the acoustician's compromise on his preference to change the site of the boiler room (7.4). As this case illustrates, project documents may play a role in "rejecting" participant proposals by fixing a decision, thus closing discussion on specific issues. For example, University administrators required a change in the building entrance design, overruling the architects' solution (Section 6.3). In contrast, some client preferences were constrained by fixed decisions, which led to compromise in the incorporation of client interests. In such cases, project documents often gained more power in persuading clients to compromise as options became fixed and constrained. For example, the acoustician assumed that the SFD expected a superior soundproofing level for the TV studio, and proposed a change in the boiler room location based on this expectation. However, the floor plans could not accommodate this proposal because the location of the mechanical space was fixed. As a result, the SFD's interest in an elevated sound proofing level for the studio was not incorporated.

As the project developed, the project documents became more empowered to influence clients and project team members' choice of proposals, in addition to facilitating their understanding of interdependencies between issues. The impact of material objects is analysed in this thesis in terms of their influence on the incorporation of project participants' interests. This is in contrast to the role of material objects in construction projects studied by Tryggestad *et al.* (2010) and Lingard *et al.* (2012), which is analysed as mediating information or actively influencing decisions about successive issues in the course of a project. This thesis analysed material objects involved in a process of specifying design options and choosing from options; how objects shaped, limited and even "rejected" various participants' preferred solutions.

8.4 Clients' relative power to impose their interests

In response to the research objective 3: To analyse how clients impose their expectations over others among the range of actors, this research analysed the impact of client engagement on the incorporation of client interests over others. The analysis also highlighted client engagement across a range of actors involved in the project. It provided a number of examples in which clients imposed their interests when directly and indirectly involved in decision-making processes.

8.4.1 Clients' power through selection of preferences

During their involvement in decision-making processes, clients endeavoured to impose their interests over those of other clients and project team members in a number of ways, including shaping the range of options, choosing from these options, and either accepting or rejecting proposals.

The clients shaped the range of options and selected their preferences in accordance with their interests. In such a client engagement process, relative client ability was evident in their ability to impose preferences. For example, with respect to the choice of ventilation system, the SFD imposed its wishes by choosing the standard system, overruling the services engineers' preference for the displacement system (Section 7.1). In other cases, the clients accepted or opposed other actors' proposals. Particularly, when interdependencies between issues were introduced, the project team members became more able to persuade the clients to compromise on some of their preferred solutions. However, it is noteworthy that the interdependence between issues often stemmed from earlier client decisions. For example, the interdependence between the height and location of Theatres 1, 2 and 3 was due to building size restrictions. Had the building footprint been larger, Theatre 1 could have remained a double-storey space. However, the size of the building was, in fact, influenced by the clients' earlier decision regarding building location.

Finally, the clients sometimes proposed a change in the fixed decisions or compromised on their preferences because of the fixed decisions. However, it is worth noting that some decisions fixed by project documents often reflected client interests. For example, the decision to locate the boiler room next to the second floor was made because the ground floor space was occupied by other required functional spaces originally presented in the SFD's brief. As a result, the ground floor, and even the second floor plan did not provide for some of the subsequent proposals, such as those to locate the mechanical space at the ground floor or roof mezzanine level, because a number of client interests were incorporated into the earlier decisions about the size and location of performance spaces and air-handling units (AHUs) fixed by these documents.

To summarise, clients' relative ability power to directly impose their interests in the project decreased over time, as the incorporation of earlier client interests often conflicted with those that emerged later. Besides, clients' relative ability to impose their interests through indirect project involvement decreased over time, because the later project stages involved more technical issues. As project team members advocated for interests on behalf of the clients that were sometimes beyond their understanding, the clients had less influence over their preferences.

8.4.2 Control over timing of participant involvement

Client control over the timing of participant involvement constituted another source of power to impose their interests. The analysis suggests a number of examples about how this control was exercised.

For some issues, the clients made decisions or set policies to support their preferences before other project participants became involved. For example, the SFD drafted a project brief that became the basis for the concept design before the architects were hired. Also, the University established its space management policy before the project began, which supported the HoSM's interest in the efficient use of campus space and conflicted with the SFD's interest in including new spaces in the building. In another example, pre-defined standards were used to calculate the size of functional spaces, which incorporated the University's interest in preventing the excessive provision of spaces. At the same time, this constrained the emergence of the SFD's desire for larger spaces and the architects' interest in making spaces open. In this way, decisions, policy and procedure that were set before the involvement of particular actors constrained their ability to impose their preferences. The architects discussed this result:

> …some of their [the client's] decisions had been driven through …not the client team [the SFD], but the University... Estates team… there was… work that had been done prior to us actually getting… involved in the design; we were then also limited.... The political machinations that the University can drive, in principle, behind, probably backed our decisions… not so much in this University…but as a general rule of thumb… there tend to be quite a lot of constraints...we've done things in a certain way, but they didn't want us to… move away from that.
>
> (Support architect interview, June 2013)

In other cases, the clients were able to decide on the timing of additional project participants' involvement. For example, the Estates Department hired tree specialists to consult about onsite tree preservation. Similarly, the campus master plan PM decided on the timing of public involvement in a way that their interests were reflected at a particular moment. As a result, public comment was reflected in the architects' revised proposals, but not in the final decision. In this way, the clients determined participant involvement based in part on whether they wanted input in decision-making processes at given moments.

In another example, the PM consulted the acoustician at certain moments during the detailed design stage. As a result, the acoustician's proposal was accepted when he was first involved, but rejected when he was consulted a second time, as the boiler room location had already been decided. Thus, the PM was able to determine the timing of the acoustician's involvement based on whether the clients wanted to reflect acoustic concerns at a particular point in the project. Although the PM's intention of such a strategy was not analysed in interview data, the architects' discussion suggests the impact of procurement strategies on the incorporation of client interests:

> (Lead architect) ...I'm remembering here that the acoustician wasn't employed at... quite at the right point, he came in a little bit late.
>
> (Support architect) I think the whole appointment was robust enough…if you had got them earlier in the design process, we wouldn't have put stuff in certain steps we had, because it can be quite difficult to have one [person] against [a] design.

(Lead architect) Yeah, especially with the plant [mechanical system]…

(Architects' discussion, June 2013)

These statements suggest that the PM's involvement of the architects earlier than other project team members allowed for prioritization of architectural design decisions over acoustic design criteria. This strategy seems in agreement with the SFD representative's interest in constructing facilities for teaching rather than professional purposes[66], suggesting that she prioritized the architectural design over the acoustic design of the theatre facilities. In this way, the clients' ability to control the involvement of certain team members' could potentially be used to prioritize interests earlier in the project, leaving lower priority concerns for later.

However, this strategy is effective only if imposed client interests are associated with specialists' formal roles. For example, clients may elect for the earlier involvement of architects and the later involvement of an acoustician by prioritizing architectural design over acoustic design. However, aside from their interest in aesthetics, certain architects may also be interested in acoustics in the same way that particular services engineers may be interested in aesthetics in addition to their interest in conserving energy. However, such actor interests outside their formal roles cannot be foreseen before the involvement of project team members.

To summarise, clients' control over the timing of participants' involvement could potentially be used to limit other actors' influence at a particular moment. This control can be exercised even at later project stages, which stands in contrast to client ability of choosing their preferences, which becomes more constrained over time. However, in order to impose some client interests over others, this control is most likely only exercised when these interests are associated with specialists' formal roles.

[66] Due to the simplicity of the required theatre facilities, the SFD representative stated that she wanted an architect with experience in educational facilities rather than one who specialised in theatres.

9 Conclusion

This thesis explored client engagement situated within the dynamic networks of a range of actors involved in a building project. More specifically, the research traced client interests among a range of actor interests. The way a number of actors, their interests, their proposals and the decisions circularly influenced each other was documented with regard to a number of issues within a building project. The analysis revealed the impact of client engagement on the incorporation of client interests over others, in other words, how clients impose their interests over others in the course of the project. The findings fulfilled the aim of the thesis: To explore the way client expectations shape a project and influence the completed building.

9.1 Findings

ANT analysis of discussions and negotiations about a number of issues in the course of a project provided insight into dynamic decision-making processes in terms of how actors impose their interests. Initially, it was found that clients promote their interests by shaping the range of options and making proposals. However, later in the process, project team members tend to specify or modify their proposals based on the constraints posed by interdependencies between issues. As earlier decisions fixed in project documents circumscribed or conflicted with those yet to be determined, actors changed or compromised on their preferences. In this way, the relative ability to impose their own interests shifted from clients to project team members, and to project documents as available options became more constrained as the project developed.

In turn, the analysis provided a basis for reflection on the way clients impose their interests among the range of other actors involved in the project. As a project developed, clients' ability to select options became more constrained, and project team members became more empowered to project client interests in their proposals, often without tacit client approval. Clients, however, did not lose all influence at the end of this process; rather, they retained the control over the timing of other participants' involvement, and in this way, to impose their interests (although the empirical data did not suggest the clients' intentional exercise of this control). For example, clients were able to involve members of the public at a certain point of decision-making processes, but at another point. Also, clients set policies before other actors' involvement, or involve other actors after particular decisions are fixed.

9.2 Theoretical and methodological contribution

Theoretically, this thesis developed the concept of "interest" within ANT analysis. While similar concepts such as needs, requirements, goals and expectations have been analysed in construction management research (e.g. Connaughton 1993), these studies tend to differentiate between organizational/individual, specification levels using these concepts. In contrast, "interest" is analysed in this thesis in the context of the dynamic range of actors' discussions and negotiations whereas actors include individuals, groups and organizations who are involved at different times in a project. More specifically, the ANT perspective used for this study suggested the value of viewing a building project as the product of a range of actor negotiation and persuasion processes over its duration. Within this framework, actor interests are analysed as constituents of actors' proposed solutions or those which emerged in response to other actors' proposed solutions during persuasion and negotiation processes. As a result, it allowed for an analysis of the incorporation of some actor interests over others in the course of a project.

Within this analytical framework, dynamic client engagement in decision-making processes was documented, which varied around a number of issues. Clients shaped the range of options, chose from options, accepted or rejected proposed solutions and were absent from decision-making processes. During such client engagement processes, client interests were a basis of their preferred solutions, as wells as were ascribed by other actors in their proposals. Significantly, client interests were analysed even in the absence of clients when their interests were projected by project team members in their proposals.

By particularly studying the range of actors' engagement in decision-making processes and their influence on the incorporation of their interests, this thesis revealed actors' ability to impose their interests over others. This concept of "power" is similar to that of stakeholder management literature (Newcombe 2003; Olander 2007) which analyses the likeliness of actors' enforcement of their expectations. Although these authors analysed participants' "power" to assist project managers' strategy to avoid conflicts between stakeholders who have different expectations, this thesis analysed their power to impose their interests during their discussions and negotiation processes over the choice of one option over another which resulted in project decisions.

Methodologically, the post-project approach was advantageous in that it allowed for relatively clear emergence and selection of issues and actor interests throughout the project. Interviewing subjects after the project completion also helped in identifying the key issues among the numerous project discussions and challenges involved, as well as in consolidating them as "topics". For example, interdependence between the ventilation system and the office space layout decisions would have been difficult to see in the real-time study. Also, the interview data allowed for clear identification of actor interests with respect to particular proposals. For example, the architects proposed the single-height of Theatre 1 based on a number of interests, including opening the ground floor, easy access to a shared storage space for both Theatres 2 and 3, and creating an acoustic buffer between these two theatres. However, it is not clear from the document which particular interest of the three was a basis for the proposal of the single-height of Theatre 1. Instead, the interview data helped to clarify the particular interests that were a basis for the architects' respective proposal.

9.3 Practical implication

The findings of this study suggest practical implications regarding the incorporation of client interests over the course of design projects, namely that multiple client interests are involved around particular issues and that some of these interests will inevitably conflict with others. In addition, client interests that shape earlier fixed decisions may conflict with client interests that emerge later in a project. Thus, not all interests are ultimately incorporated into the development of a project.

In turn, the analysis suggests recommendations for achieving greater client awareness and understanding of the often-conflicting client interests in decision-making processes. One suggestion for construction clients would be to explore how to increase their understanding of the way design team members project their interests onto clients. Often, technical requirements, such as acoustic levels or set temperatures, are difficult to understand, particularly for users, and improving client understanding (e.g. through building tours or laboratory simulations) could assist clients in better identifying and prioritizing different interests.

Another client-related suggestion would be to consider how communication of the often interdependent nature of issues could be improved. Document integration, such as the incorporation of building information modelling (BIM) application, could facilitate client understanding of how decisions shape or constrain subsequent design options. Such understanding could assist clients' understanding of the effects of preferred solutions on subsequent issues.

9.4 Limitation of the research

This research posed a number of challenges theoretically and methodologically. While ANT application to a building project process allowed for the analysis of a range of actor interests in the project, it also tended to blur the analytical distinction between actors, their interests, and their proposals. As a result, the difference between client interests and other actors' interests (project team members and documents) was not always clear. For example, the distinction between the architects' and the clients' wishes was often not clear when they crafted their proposals through mutual discussion (e.g. the creation of the shared storage space).

Similarly, the difference between project team members' own interests and their projection of those of the clients was sometimes difficult to discern. For example, a number of project team members were interested in reducing costs, particularly at the detailed design stage, when client presence was low (e.g. the structural engineers' proposal about beam design and the project team members' rejection of the use of an under-floor plenum for ventilation system design). This was because cost reduction became an agreed-upon project goal for all project team members after the University decided to reduce the project budget. In order to manage such vague analytical distinctions, the data for this study were presented in a somewhat simplified form; thus, actor interests and changes in these interests were often not as clear or distinct as described in the analysis.

Methodologically, the post-project study presented disadvantages, particularly in collecting data on decision-making processes regarding complex and highly technical issues (e.g. the coordination of high-access platforms, duct routes and light fixtures in cable net system design topic). Often, project team members did not recall why they chose one design option over another regarding these issues, a factor that was fundamental in analysing their interests. Furthermore, although a number of design drawings documenting different points in the project were accessible, the complexity of these drawings often made it difficult to trace how incorporating actor interests at particular moments drove specific design development.

This research is based on a post-project study, in order to trace client interests in the course of the project. However, an additional real-time study focused on complex and technical design decision-making processes would provide insight into the dynamic power relations of a number of specialists (e.g. architects, structural engineers and services engineers). More specifically, different professionals' abilities to impose their interests and a variety of strategies to persuade other actors could potentially be further analysed using this research framework.

Also, clients' control over the timing of participants' involvement is further studied as a strategy to impose their interests over others in the course of a project. The finding of this thesis suggested the PM's potential ability to control the specialists' involvement in relation to the ongoing development of project documents. The further study can explore if this power is exercised intentionally in a construction project.

To summarise, this thesis traced the incorporation of client interests in the course of the project. Using ANT and particularly the concept of interest, this thesis explored multiple and shifting client interests in decision-making processes in the course of the project. More specifically, successive negotiation and persuasion processes between the range of actors were analysed within a single building project on the University campus. This analysis documented dynamic client engagement in decision-making processes across a range of actors and issues in the course of the project, and thus, the analysis of client interests ascribed by project team members even during the absence of clients. The findings particularly highlighted shifting power relationships between clients, project team members and material objects in the course of the project. Clients' relative ability to impose their interests by selecting their preferred solutions became more constrained as the project developed and available options became more constrained because of an increase in interdependencies between issues. However, this relative loss of control was countered by clients who continued the control over the timing of participants' involvement, and thus the way to impose their interests even at the later stage of the project. Based on these findings, this thesis suggests clients' greater awareness of conflicting client interests during client engagement in decision-making processes in order to impose their interests effectively in the course of a project. Also, it suggests a further research on clients' strategic control over the timing of participants' involvement in order to impose their interests over others.

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Appendix 1: List of actors (Chapter 5-7)

Client team members

School of Film and Drama (SFD)	SFD representative
	SFD Head
Board of Governance (BG)	Vice Chancellor
	Deputy Vice Chancellor
	Financial Officer
Other University administrators	Heads of the School in Humanities/Language
	Dean of the Faculty (DF)
Estates Department	Head of Space Management (HoSM)
	Internal Project Manager (PM)
	Assistant Ground Manager
	External Project Manager (PM)

Project team members

Architects	Lead architect
	Support architect
	Architectural technician
	Services engineers
	Structural engineers
	Acoustician
	Contractor
	Supplier