ABSTRACT

Title

DYNAMICS OF EARLY PROJECT COLLABORATION IN CONSTRUCTION PROJECTS

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Background and Justification

One of the key difficulties related to engaging in collective interactions in the context of construction projects is how we define and understand 'collaboration', and consequently, how this affects people's collaborative behaviour. According to Zimina et al. (2012), the lack of understanding of what collaboration means and which actions it implies still hampers integrative practices in construction. Part of the problem with the term 'collaboration' is that activities which may vary in intent and degree of participation, are usually not differentiated (Kvan, 2000). Consequently, in the context of a construction project, diverse concepts of collaboration may coexist, been hold by different participants, eventually causing disruptions in progress of activities due to a lack of shared understanding on what is collaboration and how it is realised. In this sense, the lack of shared understanding is a crucial problem in collaborative design (Cross and Cross, 1995; Maher et al., 1996; Valkenburg, 1998; Arias et al., 2000; Kleinsmann and Valkenburg, 2008; Qu and Hansen, 2008). Moreover, designers usually have limited awareness and understanding of how other designers operate in the project and how their work has interdependencies with others in the design task (Cross and Cross, 1996; Fischer, 2000; Arias et al., 2000). Consequently, the major impact of such lack of shared understanding, is that team members cannot realise the consequences of incompatible design decisions, which can hamper later activities, creating negative interactions and causing unnecessary iterative loops (Valkenburg, 1998; Arias et al., 2000).

Shared understanding implies similarity of understanding in relation to a particular phenomenon (i.e. goals, task, problems, situation), involving the emergence of the abilities to form expectations and predictions regarding future states, actions, events (Smart, 2011). Interestingly, this key idea of shared understanding as a collective ability to conceive future states, aligns with the fundamental concept of design as a purposeful activity to change a situation (Simon, 1969; Rittel, 1987; Cross and Roy, 1989). Therefore, shared understanding can be considered a key aspect of collaboration in design, especially in the way the collection of individuals understands and conceptualise the phenomenon of 'collaboration' in itself. In this context, previous research argued that traditional concepts of collaboration embedded in prescriptive models of collaborative design activity do not properly addressed the social constructive nature of design, and consequently failed to allow the development of particular abilities required to engage in collective creative situations (Coyne and Snodgrass, 1993; Dorst, 2006; Shelbourn et al., 2007; Forgues and Koskela, 2009; Forgues et al., 2016), which are often related to early project stages.

It has been suggested that the uncertain nature of early project stages requires that participants in a team conceive a common model, rather than follow predetermined ones (Macmillan et al., 2001; Badke-Schaub et al., 2007), as a way to build shared understanding of the collaborative activities. During design, individuals will interact to express their expectations and predictions of future states of the project activity (i.e. design schemes and plans), which become object of interaction through means of representations (i.e. verbally and graphically). In this case, concepts of collaboration will be embedded in the artefacts that participants design and use to support collective activities (Tomelleri et al., 2015).

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According to the Activity Theory, every human act should be understood as an Activity System, in which human actions involve a triad of subject, object and mediating artefacts, leading to a cultural mediation of actions (Vygostky, 1978). In this sense, human actors work within a broadly objective, but socially and culturally defined reality (Nardi, 1996). More importantly, their activities are themselves mediated by tools, as mediating artefacts, that are culturally biased, and which consequently, are developed and transformed during the activities (Nardi, 1996; Engeström, 2001). Therefore, these artefacts can be realised in terms of institutions, organisations, systems, methods, norms and rules, which contribute in generating, maintain and reproducing these tangible interactive practices (Tomelleri et al., 2015).

Consequently, problems of lack of shared understanding around the concept of collaboration can emerge during Early Project Stages, with the early engagement of the key members of the project team (i.e. client, designers, contractors and supply chain), by the means of interacting artefacts. At this stage, key project players, which are used to conceive and structure their own activities using different models of collaboration embedded in traditional forms of contract (Koskela et al., 2006) or standard project procedures (Forgues et al., 2016), have to interact to design the current model of collaboration for the project. However, when they need to converge and compromise in a coherent model of collaboration for the specific project, they usually face what are commonly described as "collaboration problems". These problems are affect by eventual misunderstandings among project participants, which are manifested through different languages, standards and wrong assumptions between project participants (Parrish et al., 2008). This potentially generates frustration, alienation, insecurity, hopelessness and unrest in social settings (Gharajedaghi and Ackoff, 1984). More importantly, these different models of activity, will also carry embedded individual understandings of collaboration, and may result in misunderstandings around the overall concept of collaboration for the project. This is because each participant is referring to their own expectations, background experience, different disciplinary fields, and so establishing different perspectives over keys aspects of the purpose of *team, task, process and competences* (Badke-Schaub et al. (2007), on their collective interactions.

In this case the study of participants' communicative interactions in the Early Project Stage can support the investigation of these lack of shared understanding. In this case, communication can be considered as not only the medium for social interaction, but rather the context in which these interactions emerge and shape social behaviours (Pearce, 1989). The philosophical stand in this argument is that reality is not objectively given, but rather constructed through social interactions generating interpretations, as collective meanings, that emerge from conversations among individuals in the social space (Gergen, 1985). More specifically, Tomelleri et al. (2015) suggests that collaborative interactions are affected by symbolic representations of reality, embodied in metaphors and language, would indicate a way to understand the dynamics of lack of shared understanding in collaborative activities.

People usually refer to metaphors to explain the artefacts they create and use in interactions (Morgan, 1986). According to Tomelleri et al. (2015), symbolic representations as metaphors are tools that build social relationships, generating consistency between individuals' inner world and their social environment. A metaphor implies a socially shared way of thinking and perceiving a situation and its ability to produce change, and they unconsciously establish a sense of performance (i.e. success or failure) to the same practices (Tomelleri et al., 2015). For example, traditionally people have been using metaphors of a "machine" or a "biological organism" to refer to the way institutions and organisations are conceived and operate (Gharajedaghi and Ackoff, 1984; Morgan, 1986; Green, 1996). As well as metaphors of "thing" and "process" have arguably supporting the development of two main conceptual models of production and construction management (Koskela and Kagioglou, 2006). Therefore, the metaphors, by which we perceive and interpret situations, not only influence our behaviour but they also become social actions with prescriptive values (Morgan, 1986). Consequently, if there are differences in the way people perceive the

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purpose of activities within the collective act, as indicated by Kvan (2000), this should be influenced by inherent metaphors of collaboration these players hold.

Research Aim

The aim of this paper is to present a way to study and improve collective interactions at Early Project Stage of construction projects through the inquiry into underlying concepts of collaboration embedded in the metaphors and artefacts of interaction (i.e. conversations, sketch drawings, procurement contracts, information systems, co-location meetings).

Research Method

The discussion and findings presented on this paper are based on a literature review in the fields of Design Research, Construction Management Research, Operations Management Research over the topics of *collaboration* and *collaborative design*.

Results and Conclusions

This paper presents a model of collective actions in construction projects that explains the coexistence of diverse concepts of collaboration at early project stages. The model also explains the emergent misunderstandings among project participants when these concepts clash through metaphors and artefacts, while the participants seek compromise in designing and planning over collective activities. The development of the proposed model is based on the Activity Theory framework, and focus on the socio-constructive nature of project activities. The proposed model suggests that to overcome the lack of shared understanding at Early Project Stage, participants need to be aware of the underlying concept of collaboration embedded in their metaphors and artefacts of practice, and consequently, engage in collective reflective activities to build shared understanding about their idea and means of collaboration in the project.

The underlying assumption on this model is that participants usually are not aware of the incompatibility among concepts of collaboration that they create and use. Moreover, most of these concepts are expressed in terms of artefacts that carry a *determinist approach* by nature, and are not meant to be questioned or contextualised. The socio-constructive perspective of collective interactions, argue that early project stages are *Self-determined* situations, in which a dialectical process emerges from collective interactions of interpretation and repositioning. Therefore, it could be said that collaboration is in fact a state of mind established by the co-construction of a collective perception of this interaction. Consequently, only the collection of the people in the context of the situation can have a measure of the performance of collaboration based on their collective perception of the level of satisfaction on their interdependent actions, as an overall reflection and feedback on their purposeful engagement.

The model is just the first step on the development of a strategy to improve the performance of collaboration in early stages of construction projects. Further research should explore the adoption of socio-constructive approaches, i.e. game activities or change experiments, as ways to stimulate reflective attitudes among project participants in order to breakdown underlying assumptions embedded in the artefacts of practice and to force them to suggest new metaphors to bridge understanding among the participants.

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