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HOW ORGANIZATIONAL CONTROL AND TIME PRESSURE JOINTLY AFFECT DESIGN CREATIVITY: A CONFIGURATION ANALYSIS

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Abstract

While organizational control and time pressure are ubiquitous to design services, their co-existence brings about intricate impacts on design creativity. This study thus aims to examine how organizational control and time pressure jointly affect design creativity. It adopted a configurational perspective to investigate the combined effects of multiple control strategies (i.e., outcome, behavior, and clan control strategies) and time pressure on design creativity, taking architectural and engineering (A/E) design as the empirical setting. A questionnaire survey was conducted in Hong Kong, involving 222 design professionals from 193 A/E design firms. The data were analyzed using Fuzzy-set Qualitative Comparative Analysis (fsQCA). The results find two configurations of control strategies and time pressure associated with a high level of creativity. Both emphasize the central role of clan control and the avoidance of behavior control. While C1 indicates the absence of time pressure, C2 embraces the presence of outcome control. There are three configurations inhibiting creativity, which all agree on the absence of clan control yet each has distinct core and periphery conditions. Specifically, C3 highlights the presence of outcome control, whereas behavior control is the core condition and time pressure is the periphery condition in C5. C4 indicates the absence of time pressure and behavior control. This study advances the understanding of configurations of control and time pressure affecting design creativity and offers managerial implications to reconcile them in A/E design firms.

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Keywords: architectural and engineering (A/E) design, control, configuration analysis, creativity, time pressure.

1. Introduction

Creativity has been recognized as a valuable fortune and distinctive competence of design firms, such as A/E design and advertising firms [1]. It refers to the generation of novel and valuable ideas about products, services, or procedures [2]. Design firms place considerable value on the creativity of design professionals as they rely heavily on design professionals to customize knowledge-intensive services [1]. In the meanwhile, design firms are highly dependent on organizational control to ensure efficient operations. Organizational control is pervasive in day-to-day operations to ensure design professionals act in ways that are aligned with the organization's goals and objectives [3].

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While the interrelations between organizational control and creativity were widely examined, these would be particularly intricate in design firms where time pressure emerges as a nonnegligible disturbance. Design firms, as project-based organizations, usually undertake temporary tasks of one-off projects (e.g., A/E design for building projects) with specific start and completion times and tight deadlines [4]. The co-existence of organizational control and time pressure would bring about intricate effects on design creativity.

However, while time pressure has been found to alter the use of control strategies [5] and affect creativity [6], how it interacts with control strategies in influencing design creativity remains unclear. This fails to provide consistent guidance on reconciling creativity with control under time pressure in design firms. To fill the knowledge gap, the following research question is proposed: how do organizational control strategies and time pressure jointly affect design creativity? Taking A/E design as the empirical setting, the specific research objective is to examine the combined effects of formal controls (i.e., outcome and behavior controls), clan control, and time pressure on design creativity.

This study seeks to make significant contributions to both academia and industrial practice. It provides empirical evidence for the combined effects of control strategies and time pressure on design creativity. The findings will direct managers to select appropriate control strategies, which is beneficial for design firms to protect design creativity under time pressure without losing control and authority.

2. Literature

2.1. Creativity and time pressure in A/E design firms

Creativity is defined as the production of novel and useful ideas or problem solutions [2]. It focuses on the generation of ideas regarding products, services, or procedures [7]. A/E firms are featured as creative organizations that offer creative solutions to design-related problems [8]. It uses architects' and engineers' intuition and imagination to translate clients' requirements into feasible solutions. Creativity contributes to not only A/E design but also the overall building project by facilitating esthetics or functionality, optimizing resource utilization, increasing safety, and solving problems intelligently [9]. Thus, creativity has been recognized as a critical resource for A/E design and a distinctive competence of A/E design firms [1].

Time pressure, the perceived deficiency of time to complete required tasks [10], is also ubiquitous in A/E design firms. Time pressure has been identified as a common feature of project work given that completion by due date is one of the most frequently used criteria for project success [11]. Design professionals from A/E design firms thus suffered from time pressure to develop innovative designs [4]. Nevertheless, empirical evidence from A/E design firms is sparse. It remains unknown how design creativity is affected by a high level of time pressure.

2.2. Organizational control and its effects on creativity

Organizational control is considered integral to organization functioning. It involves any attempts of managers to direct employees' attention, behaviors, and performance to align with the organization's goals [3].

There are two types of control strategies, namely formal and clan control. Formal control relies on official rules to monitor and evaluate activities and performance [12]. It is divided into outcome and behavior control [13]. The former aims to attain the prespecified interim and final outputs, while the latter focuses on compliance with prescribed procedures [14]. Clan control, a "soft" form of control, is a value-based

strategy [15]. It uses social strategies to develop shared values, norms, and beliefs among employees within the organization [16].

The control-creativity relations were widely examined in previous research, drawing contradictory conclusions. Some studies have shown that organizational control, and formal control in particular, impedes creativity and innovation [17]. Another stream of studies, however, is less pessimistic, arguing that control does not always impede creativity [17, 18]. For instance, the empirical research conducted by [19] shows that the use of control enhances creativity, both directly and through facilitating empowerment.

In terms of the research context, prior studies are mainly conducted in organizations that rely on physical resources to produce tangible products. Also, design professionals working in A/E design firms are quite different from the workforce delivering tangible products. Their creativity thus may be affected intricately by perceived control and time pressure.

3. Conceptual framework

Generally, multiple control strategies are used simultaneously [20] and time pressure is pervasive in A/E design firms. Multiple control strategies and time pressure thus might jointly affect design creativity, whereas the combined effects would be particular complex. On the one hand, a high level of time pressure might tempt design professionals to search for novel solutions that can save time and raise efficiency. Such effects might be enhanced by the outcome requirements and procedural gates set by formal controls. Design creativity thus would be intensified by the combination of time pressure and control strategies. On the other hand, high-level time pressure might engender a loss of enthusiasm and an inability to act creatively [11]. It is also highly possible that heavy time pressure might intensify the oppressing effects of formal controls and prevent clan control from information-sharing and joint decision-making. This subsequently reduces design professionals' intrinsic motivation and effort for creativity. Therefore, it is predicted that there exist combinations of control strategies and time pressure that nurture or inhibit design creativity.

Accordingly, a conceptual framework is developed as shown in Fig.1. Multiple control strategies (i.e., outcome, behavior, and clan controls) are adopted in A/E design firms, with presence of a high level of time pressure. Control strategies and time pressure may work jointly in affecting design creativity. The proposed conceptual framework was preliminarily validated by expert interviews of 16 experienced A/E design professionals in Hong Kong.

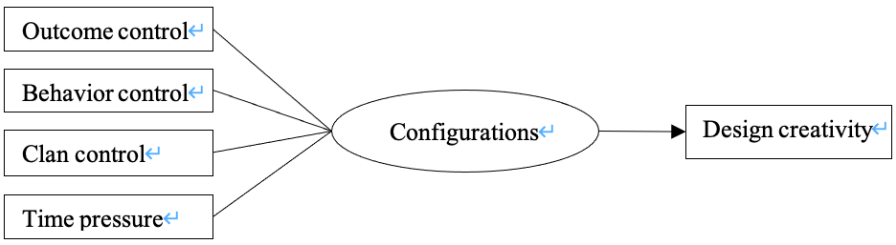

Fig. 1. Conceptual framework

4. Research methods

4.1. Questionnaire survey

This study adopted a questionnaire survey for data collection. The population comprised design professionals served in A/E design firms in Hong Kong. A/E design firms were initially sampled, and

design professionals nested in firms were then sampled. The information on A/E design firms was collected from Hong Kong Special Administrative Region (HKSAR) Government lists of A/E consultants and corporate members of professional associations, such as the Hong Kong Institute of Architects (HKIA) and the Hong Kong Institute of Engineers (HKIE). Overall, the sampling frame consisted of 193 A/E design firms, including 126 architectural, 16 landscape architectural, and 51 engineering design firms.

Each firm was asked to select five design professionals to complete the questionnaire, and 40 questionnaires for eight firms bounced. At the end of the survey, 222 valid responses were received, with a response rate of 24%. The sample profiles are reported in Table 1, showing a broad spectrum of respondents' composition.

Table 1. Sample profiles.

Descriptions	Frequency	Percentage
Gender		
Male	162	73.0
Female	60	27.0
Age		
Under 30 years	78	35.2
30-40 years	66	29.7
41-50 years	42	18.9
51-60 years	20	9.0
Over 60 years	16	7.2
Professional background		
Architect/Architectural designer	94	42.3
Landscape architect/designer	23	10.4
Structural engineer	27	12.2
Building service engineer	36	16.2
Civil engineer	19	8.6
Geotechnical engineer	9	4.1
Others	14	6.3
Total	222	100.0

4.2. Survey instrument

The survey instrument was developed based on the existing mature measurement scales, with a few revisions to adapt to the context of A/E design firms. Specifically, Internal *outcome control (IOC)* concerns the ex-ante benchmarks setting and ex-post outcome evaluation, using a three-item scale proposed by [21]. The scale of internal *behavior control (IBC)* was derived from [22], reflecting the extent to which A/E design firms monitor, track, and adjust the working process. Internal *clan control (ICC)* was assessed by the scale of [23], highlighting common goals, shared values and norms, joint problem-solving, and co-learning. *Time pressure (TP)* aimed to evaluate the extent to which professionals perceive the time available for A/E design tasks as insufficient [11]. The measurement scale containing three items was adapted from [24]. Besides, the measurement scale of *design creativity (DC)* was adapted from [25]. These scale items were measured by a five-point Likert scale (1=strongly disagree, 5=strongly agree), which workability of the survey was pretested with 14 academics and 12 practitioners in a pilot study.

4.3. Analytical methods

Data analysis was conducted in two stages. Structural equation modeling (SEM) was employed in the first stage with Mplus statistical software 7.4 to assess the data reliability and validity. The second stage utilized Fuzzy-set Qualitative Comparative Analysis (fsQCA) to test the combined effects of multiple control strategies and time pressure on design creativity. This study separately analyzed the configurations associated with the presence and absence of high-level creativity. The fsQCA is flexible in sample size, ranging from very small to large sample sizes.

5. Results

5.1. Data reliability and validity

The confirmatory factor analysis (CFA) was conducted to evaluate the reliability and validity of the data. The measurement model shows a good fit with the covariances produced by the dataset with Chi-square (df)=254.599 (142), RMSEA=0.060, CFI=0.929, TLI=0.915, SRMR=0.055. Besides, all item loadings (0.647~0.832) are greater than 0.6 with significance ($p<0.001$). The values of the average variance extracted (AVE) (0.552~0.623) exceed 0.5. These suggest an acceptable level of convergent validity. The values of composite reliability (CR) (0.799~0.873) are above 0.7, showing adequate internal consistency of constructs. For discriminant validity, it meets the Fornell-Larcker criterion that the square root of the AVE is greater than the correlations of the construct with the remaining constructs.

5.2. Configuration analysis

Configuration analysis proceeded in three steps in fsQCA software package 4.0. First, calibration of measurements. The values of the 95th, 50th, and 5th percentiles of the conditions and outcome were assigned as the full membership, crossover point, and full nonmembership, respectively. The second step analyzed the necessity conditions. The results in Table 2 how that all consistency values are below the threshold of 0.9, indicating that no individual condition is the necessary condition for the presence and absence of design creativity.

Table 2 Results of necessary conditions test.

	Outcome variable: cDC		**Outcome variable: ~cDC**	
	Consistency	**Coverage**	**Consistency**	**Coverage**
cIOC (~cIOC)	0.6723 (0.5852)	0.6906 (0.6009)	0.5897 (0.6820)	0.5739 (0.6635)
cIBC (~cIBC)	0.7160 (0.5743)	0.6988 (0.6322)	0.6473 (0.6697)	0.5903 (0.6984)
cICC (~cICC)	0.8010 (0.4971)	0.7230 (0.5922)	0.6386 (0.6760)	0.5461 (0.7629)
cTP (~cTP)	0.6624 (0.6084)	0.6661 (0.6385)	0.6364 (0.6494)	0.6062 (0.6457)

The final step conducted the sufficiency test. A truth table was initially constructed, listing all possible configurations of causal conditions. Two thresholds, consistency (>0.85) and frequency (> three cases), were adopted to assess whether configurations were sufficient for explaining the outcomes. Sufficiency analysis subsequently generated three possible solutions, including complex, parsimonious, and intermediate solutions. Researchers usually report intermediate solutions, while parsimonious solutions are used for distinguishing core and periphery conditions.

The results of the sufficiency analysis are reported in Tables 3 and 4. Table 3 lists two configurations that are sufficient for the presence of high-level design creativity, showing that two configurations would nurture design creativity. Both emphasize the central role of clan control and the avoidance of behavior control. While C1 indicates the absence of time pressure, C2 embraces the presence of outcome control. The consistency values of the two configurations are 0.8555 and 0.8310 (>0.8), and the coverage

values are 0.3721 and 0.3794. The values of solution consistency and coverage are 0.8145 and 0.4270 respectively. The results demonstrate the sufficiency of two configurations to engender high-level design creativity.

Table 4 reports three configurations explaining the absence of design creativity. All three configurations agree on the absence of clan control, yet each has distinct core and periphery conditions. Specifically, C3 highlights the presence of outcome control, whereas behavior control is the core condition and time pressure is the periphery condition in C5. In addition to clan control, C4 also indicates the absence of time pressure and behavior control. The consistency values of the three configurations range from 0.8284 to 0.8920. The coverage values range from 0.3614 to 0.4413. The overall consistency and coverage of the solution are 0.8238 and 0.5923 respectively, indicating that these three configurations are sufficient for the low-level design creativity.

Table 3. Results of sufficiency test for the presence of design creativity.

	C1	**C2**
cIOC		●
cIBC	⊗	⊗
cICC	●	●
cTP	⊗	
Consistency	0.8555	0.8310
Raw coverage	0.3721	0.3794
Unique coverage	0.0476	0.0549
Overall consistency	0.8145	
Overall coverage	0.4270	

Note: The black circles indicate the presence of conditions, while the crossed-out circles denote the negation. The blank spaces show the irrelevancy in shaping the outcome. The large and small circles represent the core conditions and peripheral conditions, respectively.

Table 4. Results of sufficiency test for the absence of design creativity.

	C3	**C4**	**C5**
cIOC	●		
cIBC		⊗	●
cICC	⊗	⊗	⊗
cTP		⊗	●
Consistency	0.8284	0.8920	0.8625
Raw coverage	0.4222	0.4413	0.3614
Unique coverage	0.0471	0.1152	0.0344
Overall consistency	0.8238		
Overall coverage	0.5923		

Note: The black circles indicate the presence of conditions, while the crossed-out circles denote the negation. The blank spaces show the irrelevancy in shaping the outcome. The large and small circles represent the core conditions and peripheral conditions, respectively.

6. Discussion

This study examines the combined effects of multiple control strategies and time pressure on design creativity, identifying configurations associated with the presence and absence of creativity. Specifically, two configurations nurturing design creativity (C1 and C2) both indicate that the presence of clan control and the avoidance of behavior control are core conditions. Meanwhile, it is better to relieve time pressure or add outcome control to sustain the benefits of clan control on design creativity. When combined with control strategies, time pressure is perceived as external regulation and constraints that further dampens the promoting effect of clan control. This has been found by [27] that low time pressure is the optimal situation for employee creativity when the innovation climate is high (e.g., high-level clan control in this study).

Besides, configuration analysis identifies three situations associated with low-level design creativity, namely results orientation (C3), amotivation (C4), and strong constraints (C5). While the lack of clan control is common in three situations, results orientation by emphasizing outcome control encourages design professionals to design less creatively and employ simple solutions in response to the deliverable requirements. The situation of amotivation where time pressure and behavior control are also absent reflects that design professionals are demotivated to act creatively with little pressure. On the contrary, the coexistence of time pressure and behavior control exerts strong constraints on design professionals and limits the leeway on design creativity. The implication is that when clan control is absent, managers should be careful of the use of outcome control, co-occurrence and co-absence of behavior control and time pressure.

7. Conclusions

This study contributes to the body of knowledge in two ways. First, it extends research on control-creativity relations to the design sector. Previous studies primarily explore control-creativity relations in organizations that produce tangible products. Their findings might not apply to design firms that customize knowledge-intensive and intangible services. Taking A/E design as the empirical setting, this study advances the understanding of the relation between control and creativity.

Second, this study provides the empirical evidence for the combined effects of multiple control strategies and time pressure on design creativity. Time pressure permeates A/E design, and it might interact with control strategies in affecting design creativity. Through configuration analysis, this study identifies two configurations that foster design creativity, and three configurations associated with the absence of design creativity.

This study also provides many managerial implications. First, it reliefs managers' concern about the side-effects of control and time pressure on design creativity. Managers are allowed to employ control when facing time pressure and protecting creativity, if they select appropriate control strategies. Second, managers are directed to select appropriate control strategies with consideration of time pressure. For instance, clan control is recommended, whereas behavior control should be avoided when clan control is absent.

There are some limitations of this study. First, this study merely focuses on internal control mechanisms, and future research is suggested to incorporate both internal and external control mechanisms to examine their combined effects on design creativity. Second, both architectural and engineering designers are included in the sample to examine their design creativity. Future research is expected to investigate architectural and engineering designers respectively and compare their differences in control-creativity relations.

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