

# *A game theory-based approach to the analysis of cooperative learning in design studios*

Shen-Guan Shih, Tsung-Pao Hu and Ching-Nan Chen, Department of Architecture, National Taiwan University of Science and Technology, No. 43, Sec. 4, Keelung Road, Taipei, 106, Taiwan, Republic of China

*Design studios are set up for cooperative learning and encourage peer communication throughout the design process. However, cooperative learning is difficult to achieve, because students in a studio are also competitors who make every effort to outperform their peers. A theoretical model based on the Prisoner's Dilemma game theory is proposed to analyse the complex behaviours of cooperation and competition in design studios. The result of analysis suggests that inter-group competition, iterative peer assessment, and information transparency are critical factors in promoting cooperative learning in design studios.*

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Based on the “learning by doing” philosophy (Schon, 1983, 1987), the design studio is broadly accepted as an indispensable part of design education. In a studio environment, students work together to benefit from exposure to many ideas and a wide range of information from peers and instructors (Waks, 1999, 2001). A design studio is expected to provide an environment for cooperative learning. In the ideal scenario, students work side by side collaboratively, share concepts and information openly, and disregard the fact that design is a kind of intellectual property that could be copied and reused easily by their competitors (Chiu, 2002; Goldschmidt and Tatsa, 2005).

Nevertheless, the final design proposal of each participant is essential to the assessment of the overall performance of all studio members (Anthony, 1991; Whyte et al., 2004). The results-oriented assessment often leads to complex behaviours that are interwoven with cooperation and defection. This paper discusses the causes of cooperative behaviour in a design studio setting by applying the theoretical findings of game

**Corresponding author:**  
Tsung-Pao Hu  
D9113003@mail.ntust.  
edu.tw



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theory to the design education domain. The discussion focuses on incentives offered and patterns of information sharing among students. The instructor, teaching assistant, and juror together characterise the studio learning environment, including communication patterns and costs as well as the process and objectives of evaluation, all of which can greatly influence the cooperative behaviour of students. The findings of this study provide guidelines for studio instructors to set up a favourable learning environment and to define the evaluation process and rules so that cooperative learning can be fully embraced in design education.

Game theory has been applied as an analytical basis for a wide range of research into human interactions in which the outcome depends on the interactive strategies of two or more persons engaged in competition (McCain, 2004). Applications of game theory encompass business, auctions, elections, military strategy, biology, gambling, and education. In discussing cooperative learning, this paper employs game theory to analyse the students' preferred strategies during the design process in a design studio.

### *1 Conflict within a design studio*

Cooperation in a design studio can be categorised into three types of activities. First, students can work together to gather information for a design project and transform that information into visual formats, such as models and drawings. Second, each student may come up with a different concept or background knowledge for solving design problems and can share that information to help other students. Third, students may have constructive suggestions for others that can help to improve the quality of their design. All these activities are a result of the sharing of information that is collected, transformed, or created by individual students. From this point of view, the exchange of information enables cooperation in a design studio.

One purpose of a design studio is to facilitate information sharing among peers. However, the processing of design information is time consuming and challenging and some students might find it hard to resist the temptation of free riding from others' efforts. The obvious advantage is that a selfish student may save a lot of time in doing individual work on the one hand, and by hiding information, may prevent other students from using it to achieve better performance on the other hand. "To share or not to share" is apparently a dilemma for students facing the conflict between cooperation and competition in a design studio.

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