

Chapter 42

Adapting Cognitive Walkthrough to Support Game Based Learning Design

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ABSTRACT

For any given Game Based Learning (GBL) project to be successful, the player must learn something. Designers may base their work on pedagogical research, but actual game design is still largely driven by intuition. People are famously poor at unsupported methodical thinking and relying so much on instinct is an obvious weak point in GBL design practice. Cognitive Walkthrough (CW) is a user-interface design technique that helps designers model how a type of user will understand an interface. The authors suggest that CW should be extended for use in any context where a designer must model a user's thinking. They present an extension of CW that is suitable for constructivist GBL and apply it to a previously evaluated game to understand why one section of the game was more successful than another. The CW extension explains hitherto puzzling results and suggests further development of CWs for designer support may be beneficial.

INTRODUCTION

Whilst there is much enthusiasm for using games in education, most claims have not been confirmed in studies (Foster & Mishra 2009). Conclusions about learning in games differ (Mitchell & Savill-Smith 2004; Kirriemuir & McFarlane 2004) and many evaluations of Game Based Learning (GBL)

are weak and unreliable (Wideman et al., 2007). In order to improve GBL, it is necessary to build on sound pedagogical design principles (Freitas 2006), but game design is more of a craft than science and it is not clear how to do this. Some have attempted to integrate educational theories into game design for specific pedagogical approaches like Problem Based Learning (Kiili 2007), while

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others propose identifying reliable learning mechanic patterns that can then be easily integrated into games as required, without particular change to a game designer's process (Plass et al., 2011). For most GBL designers however, pedagogical principles act as guidelines rather than reliable processes and much is left to designer intuition. It is likely that designers will make general mistakes, perhaps through commonplace mental slips or other ubiquitously human weaknesses. Furthermore, the difference between the designer's expertise and the players' means that it is easy for a designer to make incorrect assumptions about what a player will and will not understand. When we are trying create GBL to teach something, this is a problem. Outside of extensive playtesting (expensive both in terms of time and cost), there are few techniques available to designers to bridge this "gulf of understanding" (Norman and Draper 1986), mitigate risk and increase the chances that the desired learning outcomes will be achieved.

The lack of reliable, practical techniques to support GBL pedagogy *design* is paired with a similar problem when *evaluating* a completed design, or a finished game. It is not obvious how we can systematically analyse GBL to determine how closely it adheres to a given pedagogical approach. Assuming that pedagogy driven design was implemented in good faith across a whole game, it is further not clear how one can understand why results vary from one section of a game to another.

An examination of the e-Bug platform game (2013) serves as an example of the evaluation problem. The design team attempted to make decisions on sound pedagogical principles based on work by Koster (2005), Squire (2004), and Shaffer (2006) (among others) that suggested successful ways that games teach. However, after development, the game was evaluated for knowledge change. Of the 21 Learning Outcomes assessed, 3 achieved statistically significant knowledge change (Farrell et al., 2011). The evaluation speculated on

potential reasons for this but could draw no clear conclusions or suggest what changes should have been made to improve the results

Serious Game designers may be able to benefit from adapting techniques from more established fields. The Human Computer Interaction (HCI) technique Cognitive Walkthrough (CW) may be a suitable tool for supporting both design and evaluation practice. This paper argues for wider adoption of CW in GBL and suggests that the technique may be extended to support any pedagogical approach with the aim of improving consistency both in *designing* GBL and in *evaluating and understanding* knowledge change results. As a proof of concept, we present one extension of CW for Learning Through Game Mechanics (CWLTM) and use it to interpret the e-Bug Platform Game results. The CWLTM offers plausible reasons for the differences in the success of different sections of the game and supports the promise of the benefit of extending and applying CW to GBL.

THE E-BUG PLATFORM GAME

e-Bug was a European Commission, DG-SANCO funded project that aimed to improve young people's understanding of microbes, hygiene and antibiotics, with the ultimate aim of reducing antibiotic misuse. As part of e-Bug, two games were designed that could be included in, or work independently of, curricula across 18 partner countries in Europe. One of those games was the e-Bug Platform Game, designed for primary school children aged 9-11. Because the game's goal was to teach the player, it was important that it be based on good pedagogy.

Designing E-Bug to be Pedagogically Sound

It is not obvious how best to teach through games. Indeed, it is clear that there will never be a one-size-

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