Chapter 16
Levels of Failure and Learning in Games

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ABSTRACT
A qualitative case study is presented that examines learning through video games, focusing on whether player experiences of failure create opportunities for learning. Examples of collaborative play are presented from three video games, including Civilization IV, RollerCoaster Tycoon 3, and Making History: The Calm & the Storm. An inductive analysis reveals that some experiences of failure frustrate game players, leading to the abandonment of an in-game task, while others lead to increased motivation to try a different strategy. The activity-theoretic level of activity at which failure occurs is used to account for these differences in outcomes of failure.

1. INTRODUCTION
This paper is part of a larger study that focuses on how learning occurs during gameplay, looking specifically at how the design of visualizations and rules within games can guide player activity and collaboration among players (Sharritt, 2008a, 2008b, 2010a, 2010b, 2010c; Sharritt & Suthers, 2009, 2011). The study analyzes interaction among players and games, describing instances of learning where failure was encountered during collaborative gameplay that describe how the resulting gameplay either helped or hindered player motivation and the potential for learning. The motivational effect will be related to activity-theoretic levels of activity, action and operation.

1.1. Failure and Learning in Games
Theories of problem-based learning (Barrows, 1986; Evensen & Hmelo, 2000) and goal-based scenarios (Schank et al., 1993) describe how game-based learning is useful for teaching knowledge and creative thinking skills to help learners generalize knowledge across domains: yielding resourceful thinkers and creative problem-solvers.
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(Shaffer, 2006). A major difference among learning in games and traditional educational practices is that of assessment: where much of traditional education uses summative evaluation (such as tests, where knowledge is tested after it is learned in an abstract manner), games employ formative assessment in a situated environment, evaluating game player activity on the fly as players ‘play-test’ new strategies in real time. Games can offer formative assessment through player feedback that is directly relevant to the learner activities. Ongoing assessment encourages learning in video games by allowing players to evaluate the effectiveness of strategies immediately, as in situated learning that occurs naturally in non-virtual environments (Gee, 2003). Thus, the assessment is used in the learner’s own self-regulatory processes (Kierriemuir & McFarlane, 2004) rather than being produced for an external judge. Additionally, the penalty of failure is low: within games, failed strategies can be followed by trying new strategies. However, failed strategies in traditional contexts often result in strong penalties such as a poor grade, which can inhibit motivation to learn. Gee (2008) discusses learning situations and motivation in games, describing how failure in games differs from failure in traditional schooling:

There are certainly features connected to video games that help explain both the motivation they recruit and the learning they enable. One key feature is the role of failure. The role of failure is very different in video games than it is in school. In good games, the price of failure is lowered—when players fail, they can, for example, start over at their last saved game. Furthermore, failure—for example, a failure to kill a boss—is often seen as a way to learn the underlying pattern and eventually to win. These features of failure in games allow players to take risks and try out hypotheses that might be too costly in places where the cost of failure is higher or where no learning stems from failure. (p. 34)

Kapur and Kinzer (2009) introduce the concept of productive failure: learners who have had to struggle with ill-structured problems and hence experienced failure may subsequently perform better on transfer of learning tasks than learners who were initially confronted with well-structured problems. These effects are attributed to the nature of ill-structured problems: they create an environment for creative problem-solving, where more divergent explorations of the problem and solution spaces can occur. Similarly, games that require learners to strategize and explore the problem space can encourage meta-cognition and problem-solving behaviors that better prepare learners for later problem solving in both well and ill-structured domains. As described in this paper, features of game design related to their ability to keep players in the role of strategizing rather than troubleshooting are of utmost importance to player learning activities.

1.2. Affordances and Representational Guidance

The ability to use a game interface to achieve goals in a game relates to the concept of affordances, which relates to the perceived available actions presented to game players. Affordances, or potentials for action, were originally described as action possibilities an environment offers to an animal, as part of an ecological theory of perception (Gibson, 1977, 1979). Affordances are not features of objects that exist independently of actors, but rather are potentials for action that reside in the relationship between an actor and an object. About a decade later, the term reappeared and gained much usefulness for studying usability with the rapidly growing popularity of the graphical user-interface (GUI) as computers entered the home. The field of human-computer interaction focused primarily on perceived affordances (Norman, 1988) to help analyze how users interact with a software interface. Extending affordances to play in video games, games offer