Concept Learning and the Limitations of Arcade-Style Games

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ABSTRACT

This study suggests that conceptualization is the primary activity of arcade-style gameplay. Arcade-style gameplay is primarily a function of presenting concepts to players and continually requiring them to react with finer responses. The degree to which a concept is malleable determines how large its range is in gameplay. In other words, the characteristics of a concept determine its role in gameplay. The primary purpose of this article is to distinguish between two types of concepts: one that is appropriate for arcade style gaming and another that requires a different, more involved style. Designers of games, particularly of educational games, will find guidance for selecting concepts related to their instructional content.

Keywords: Arcade, Challenge, Concept, Dynamic Difficulty Adjustment, Shaping

INTRODUCTION

It has been suggested that a wide range of learning goals can be taught through a number of gaming paradigms (Becker & Fraser, 2011; Egenfeldt-Nielsen, 2006; Gee, 2003). Different game paradigms have different potentials with regard to specific learning goals. Instructional taxonomies often are used to classify learning goals into different learning domains so they can be addressed differentially. One prominent learning domain is conceptual learning, which is called upon anytime we wish to identify phenomena. In this paper, we explore arcade style gaming and its limitations for promoting mastery in the conceptual learning domain.

A concept has a very specific meaning. The term is often used by the general public, in a manner that is synonymous with terms like notions or ideas. However, instructional designers use the term, specifically, to indicate a particular type of learning domain (Merrill, 1983). A concept, in this sense, can be defined as the mental combination of entities based upon their coalescing attributes (Murphy, 2002). Concepts consist of the rules and procedures for classifying and categorizing instances of phenomena, as well as collections of those instances. These rules make it possible to discriminate and generalize instances into different classes. In other words, conceptualization allows undif-
differentiated phenomena in the world to become mentally differentiated; it allows “things” to be classified, and once classified they can be treated uniformly. Examples of concepts include items and ideas such as, bowl, computer, liberty, and IQ (Intelligent Quotient). In fact, most terms can be considered as concepts (Murphy, 2002).

We argue that this conceptualization process (e.g., experience, classification, generalization) accounts for much of the game experience and as such provides specific guidance on how to design and improve gaming interaction.

There are two types of concepts generally acknowledged. Concrete concepts are concepts that refer to entities seen directly in the physical world, while defined concepts are those that require other concepts for definition and reference (Smith & Ragan, 1999). Sky, moon, and sunrise are all concrete concepts while; democracy, health, and security are all examples of defined concepts. Concrete concepts can often be defined ostensively, by pointing directly to their referents; a relatively easy instructional task. Defined concepts are generally considered more difficult to learn compared to concrete concepts because of their relative abstractness and the number of learning pre-requisites required to classify their instances. This distinction between defined and concrete concepts is an important one because, a concrete concept, is amenable to being displayed visually, while an abstract concept, more often than not, requires a verbal description. One can imagine different games that would have capabilities for one or the other type of conceptualization.

Concepts are generally organized into structures that simultaneously indicate how a concept integrates and subsumes other concepts, as well as how a concept is distinguished from others (Ausobel, 2000; Murphy, 2002). These structures form a hierarchical taxonomy that illustrates how super-ordinate, co-ordinate, and sub-ordinate concepts relate to one another (Merrill, Tennyson, & Posey, 1992). Figure 1 illustrates a hierarchy for the concept “fiction.” Notice that as you descend the hierarchy finer distinctions must be made and yet the sub-concepts inherit all of the characteristics from the concepts higher in the hierarchy. Also notice that the hierarchy is not exhaustive. Conceptual hierarchies will accommodate new entries into the classification endlessly. For example, after being introduced to the action genre it could be added to the hierarchy under fiction.

For a species with limited cognitive processing ability (Miller, 1956), conceptualization dramatically expands our working memory (Baddeley, 2002). Once an entity has been classified then it can be used according to a single set of rules. The table that one sits at is a single instance of the concept of table. The concept of table encapsulates every table that ever existed or ever could exist. The result is a considerable extension of one’s cognitive processing abilities because each table can be treated uniformly.

**LEARNING CONCEPTS**

Concepts are particularly interesting because they require a unique type of experience to acquire or discover. When we consider gaming interaction we will have to determine whether or not those types of experience can be generated through gameplay. Learning theorists often make a distinction between concept acquisition (acquiring concepts that have been established by the community) and concept formation (acquiring concepts through direct observation and experience) (Ausobel, 2000; Bruner, Goodnow, & Austin, 1956). Concept acquisition is the primary method of instruction in formal educational settings (Ausobel, 2000).

The acquisition of concepts as part of one’s knowledge base is generally inferred from one’s ability to provide a definition, list the concept’s attributes, and most importantly to correctly classify instances of the concept (Klausmeier, 1974; Merrill et al., 1992; Mory, 1992). It is widely accepted that evaluating concept acquisition requires the ability to classify un-encountered examples. The ability to recall a definition or classify an instance of a concept that one has previous experience with is generally considered insufficient evidence for
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