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Ontology (in Games) **José P. Zagal**

An ontology is an organized collection of concepts and relationships used to represent and describe knowledge within a domain. Ontologies are a form of knowledge representation that can allow for organizing information, describing observations, and creating shared vocabularies. In the case of games, this could mean a system of classification and organization that included definitions of games, their properties, and relations to each other. For example, Stewart Culin (1907) classified and illustrated the games played by the indigenous peoples of North America by dividing them into two major classes: chance and dexterity, each with its own subcategories. Culin chose to distinguish games according to what players do and what they are played with, but an ontology of games could be organized differently depending on the goals of its developers. For instance, in the early 1980s, veteran game designer Chris Crawford was interested in providing well-defined terms that game designers could use to communicate with each other while drawing attention to the rich and varied forms in which games have manifested. In his seminal book *The Art of Computer Game Design* he describes “five major regions of games: board games, card games, athletic games, children’s games, and computer games” (Crawford 1984). The distinctions Crawford chose to establish, together with the definitions he provided for each of these regions, are perhaps dated since ontological distinctions often shift and change as new games are created or technology advances. Currently, videogames have been characterized by their technological platform (e.g. 8-bit videogame, computer game, mobile), camera perspective (e.g. first-person, 3rd person, top-down, side-scrolling), intended audience (e.g. casual, hardcore, children), gameplay (e.g. shooter, puzzle, platformer), and more. Over the years, some categories may achieve greater prominence as more games are created and the

terminology used to describe them is adopted more broadly. Similarly, new categorizations often emerge and existing ones may cease to be relevant. (See GAME GENRES) These kinds of informal ontologies are commonly developed and used by player communities and gaming media to organize information about games (e.g. release dates, reviews) and provide recommendations.

Many scholars have also tackled questions regarding the fundamental nature of games. This work could be considered as ontological in nature. Roger Caillois, for instance, proposed a conceptual model of play that considered four fundamental categories of games: agon (competition), alea (chance), mimicry (simulation), andilinx (vertigo) in addition to a cross-classification along two extremes of a continuum based on how strongly they are governed by rules (Caillois 2006) (See LUDUS VS PAIDIA). Juul's analysis of the tensions between the formal (e.g. rules) and representational (e.g. fiction, narrative) aspects of videogames led him to propose five main types of games: abstract, iconic, incoherent world, coherent world, and staged (2005). Juul's categories are an attempt to capture the ambiguity and importance that the fictive elements can have in helping players establish meaning in and from the games they play.

Developing an ontology for games is no easy task. Play-theorist Roger Caillois despaired when he noted the difficulty of "discovering a principle of classification capable of subsuming [all games] under a small number of well-defined categories" (Caillois 2006). The issue lies partly in the variety of uses of the word game together with the complex relationship that exists between game and play. Thus, most ontological work in games must either rely on an existing definition or provide one of its own. The latter is often the case since defining what a game is helps establish the framework for an ontology, clarify concepts, and explain their relationships. It should be noted that multiple definitions of games (and thus, ontologies) are often inconsistent

with each other. For some, a puzzle should not be considered a game, while others may limit themselves to games played by more than one person. Differences in definitions are not a problem since the definition of a game is more often a means to an end, rather than an end in and of itself. In this case what matters is the use and meanings that can be made from a particular game ontology.

There are also other kinds of game ontologies. Rather than classifying and organizing games, these ontologies consist of the structural elements or concepts seen in games. Two notable examples in this area are the Gameplay Design Pattern project (Björk and Holopainen 2005) and the Game Ontology Project (Zagal, Mateas et al. 2005).

In 2002 Bernd Kreimeier proposed the use of design patterns for games as a way to collect “reusable solutions to solve recurring problems” in game design (Kreimeier 2002). Björk and Holopainen extended and modified this idea by “replacing the problem-solution pair with a causes/consequences pair describing how [a] pattern can occur in a game design and how it can affect the gameplay and player experiences” (Holopainen, Bjork et al. 2007). They argued that this change allowed for “a more detailed relationship structure, having five types of relations in contrast to the original parent and child relations” as well providing support for people designing games as well as those seeking to analyze them (Holopainen, Bjork et al. 2007). The Gameplay Design Pattern project is thus an attempt to codify knowledge of game design such that it can be shared and applied towards the analysis of games and the design of new ones. Each element of knowledge, called in this case a design pattern, consists of a short description, some examples of games that exhibit this pattern, an explanation of how the patterns can be used, and the effects or consequences that pattern can have in a game’s overall design. Additionally, the pattern may be connected to other patterns via one or more relationships. For instance, a pattern may be in

conflict with another or it might instantiate it. The pattern collection is thus a web of interconnected concepts. The original collection of patterns was published in “Patterns in Game Design” (Björk and Holopainen 2005). It has since been extended and is also available online (Björk 2012).

The Game Ontology Project (GOP) also seeks to identify the important structural elements of games and the relationships between them (Zagal, Mateas et al. 2005). The GOP focuses on things that cause, effect and relate to gameplay. Representational and narrative details such as issues of setting (e.g. medieval castle, spaceship) or genre (e.g. horror, sci-fi) are not included. Each element of knowledge, called in this case an ontology entry, consists of a description of the element, a number of strong and weak examples of games that embody the element, a parent element, potentially one or more child elements, and potentially one or more part elements (elements related by the part-of relation). The GOP acknowledges that there are “fuzzy boundaries” around certain concepts: strong examples describe how an element is concretely reified in specific games while weak examples describe border cases of games that partially reify an element. For example, the notion of “Lives” as “a measure of opportunities that a player has to succeed in [a] game” (Game Ontology Wiki 2012) exists in *Pac-Man*: whenever a ghost catches Pac-Man, a life is lost with “the number of lives remaining [...] indicated by the existence of a Pac-Man icon in the corner of the screen”. In *Legend of Zelda: A Link to the Past*, however, you can only die once (play continues by reloading from an earlier save point). However, if the player happens to possess a captured fairy when he dies, he is instantly resurrected and can continue playing. “In this sense, the fairy in the bottle is functionally equivalent to Link having an extra ‘life’ stored away” (Game Ontology Wiki 2012). Using weak and strong examples helps define the center of the ontological entry, and illustrate the nuances

and interpretations an ontological definition may have. The GOP's hierarchical approach provides a natural way of navigating varying levels of abstraction: more concrete instances are "under" those that are broader or more abstract. The GOP is available online in wiki form, allowing anyone to contribute (Zagal and Mateas 2009). The Game Ontology Project and Gameplay Design Pattern Project have also proven useful in games education (Holopainen, Bjork et al. 2007; Zagal and Bruckman 2010).

Finally, work has also been done in creating ontologies that are detailed and formal enough such that they can be used to support automatic game creation. The idea is that "[a]utomatic game generators can serve as highly detailed theories of both game structure and game design expressed operationally as a program" (Nelson and Mateas 2007). Although they are often restricted to specific kinds of games (e.g. chess-like games), they can be useful for generating balanced games (Marks and Hom 2007) or automatically analyzing them (Pell 1992). This work often uses techniques developed in artificial intelligence (AI) and the ontologies created are generally described using mathematical formalisms and logic rather than natural language.

SEE ALSO: Artificial Intelligence, Game genres, Ludus vs Paidia, networking, semantic web

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