



# “Half-reliable”: A qualitative analysis of epistemic thinking in and about a digital game



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## ABSTRACT

The purpose of this investigation was to explore if and how players of digital games think about knowledge and knowing in the context of playing a game. Specifically, the objectives of the study were to examine whether players of an educational simulation game engage with epistemic aims, epistemic ideals, and reliable processes in the context of the game and to describe the nature of these aims, ideals, and processes. An exploratory, multiple-case qualitative study design was employed. Adolescent gamers were asked to think aloud while playing a sustainable development simulation game and were subsequently interviewed about the game. The results revealed that players adopted specific epistemic aims, epistemic ideals, and reliable processes in the context of the game. These were related to three layers of knowing: knowing in the game, knowing about playing the game, and knowing about the game as a representational artifact. Although players were adept in achieving epistemic aims related to knowing in the game and knowing about playing the game, they did not spontaneously engage in critical examination of the game as a representation. The study sheds light on challenges of epistemic thinking in digital games and on some of the ways in which game design can support epistemic thinking.

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## 1. Introduction

### 1.1. Why study epistemic thinking in digital games?

Epistemic thinking (Kuhn & Weinstock, 2002), or epistemic cognition (Greene, Sandoval, & Bråten, 2016), concerns what people believe about knowledge and knowing and how they think and reason about the epistemological aspects of knowing (Hofer, 2016). Thus, epistemic thinking involves beliefs, understandings, or theories about knowledge and knowing, such as beliefs about the nature of justification (Greene, Azevedo, & Torney-Purta, 2008), as well as thinking and reasoning that is related to the achievement of epistemic aims, such as attaining true beliefs, justification, or understanding (Chinn, Buckland, & Samarapungavan, 2011).

Research in the field of epistemic thinking has made great strides in recent decades, which have been recently summarized in a comprehensive handbook (Greene et al., 2016). New theoretical and methodological approaches to the study of epistemic thinking have been developed, and our understanding of the ways in which learners' epistemic thinking comes into play in various academic and social contexts has deepened (Sandoval, Greene, & Bråten, 2016). These recent developments have shed light on activities such as learning from texts, classroom inquiry, and argumen-

tation. However, they have not yet been brought to bear on the study of how people learn from digital games.

The motivation to apply the analytic lenses of epistemic thinking research to the study of digital games is twofold. First, repurposing the title of James Paul Gee's seminal book (2007), *What Video Games Have to Teach us About Learning and Literacy*, the value of studying epistemic thinking with digital games lies in *what digital games can teach us about epistemic thinking*. Games have several features that make them a potentially productive site for exploring epistemic thinking. Essentially, games are about solving novel problems (Gee, 2007; Koster, 2005). These problems are typically not easy to solve and necessitate acquisition of new knowledge and skills. Thus, games involve epistemic challenges, as players need to discover why and how things happen in the game world in order to successfully solve problems in the game. However, games very sparingly “tell” players what they need to know. Instead, the primary mode of acquiring knowledge and understanding in games involves constructing meanings by interacting with people, objects, tools, and environments (Gee, 2007, 2008). Players often need to integrate multiple sources of information and deal with imperfect information (Salen & Zimmerman, 2004). Good games motivate players to engage in such challenging activities (Habgood & Ainsworth, 2011; Malone & Lepper, 1987). Hence, digital games offer opportunities for studying *in situ* how highly

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engaged learners deal with complex epistemic challenges and novel epistemic settings.

A second motivation for studying epistemic thinking with games lies in *what epistemic thinking research can teach us about digital games*. Digital games are a highly popular form of recreation. For example, almost all teens in the US play digital games, and about one half do so on a daily basis (Lenhart et al., 2008). Digital games are also increasingly developed and used for educational purposes (Barab, Gresalfi, & Ingram-Goble, 2010; Clark, Tanner-Smith, & Killingsworth, 2016; Honey & Hilton, 2011; Mayer, 2014; Plass, Homer, & Kinzer, 2015; Squire, 2012; Wouters, van Nimwegen, van Oostendorp, & van der Spek, 2013). Research on digital game-based learning has primarily addressed the cognitive, motivational, affective, and sociocultural dimensions of learning from games (Plass et al., 2015), while the epistemic aspects of learning from games have so far received very little empirical attention (Martinez-Garza, Clark, & Nelson, 2013). Studying how learners conceive knowledge and knowing in games and how their understandings are enacted in gameplay could potentially advance our understanding of learning from digital games. Furthermore, games have unique epistemic status: They are artifacts that represent reality to some extent yet are simultaneously separated from reality by their fictional and playful nature (Huizinga, 1944/1980; Juul, 2011; Salen & Zimmerman, 2004). For example, farming games such as *FarmVille* (Zynga, 2009) represent some aspects of authentic farming, yet also introduce fantasy and limit fidelity of representation in order to create a stylized and playful experience. It is hence important to examine how players conceive the epistemic status of games as representations, especially games designed to serve informational and educational goals. The aims of this exploratory qualitative study were, therefore, to explore the nature of players' epistemic thinking both in games and about games.

Section 1.2 briefly reviews prior research on epistemic thinking in games. Section 1.3 then presents the theoretical approach to epistemic thinking that guided the study. The following Section 1.4, proceeds to lay a foundation for the analysis of epistemic thinking in games by distinguishing between multiple layers of knowing in games.

### 1.2. Prior research on epistemic thinking in digital games

The term *epistemic games* has sometimes been used in prior research to refer to the study of epistemology and games. Hence, to start, it will be helpful to disambiguate the uses of this term and to contrast them with the focus of the present study. The first use of the term epistemic games refers to games as a metaphor for ways of knowing (Bielaczyc & Ow, 2014; Collins & Ferguson, 1993; Morrison & Collins, 1996; Perkins, 1997). Collins and Ferguson (1993) described epistemic games as sets of rules, strategies, and moves that guide inquiry and aim to produce representations that satisfy the inquiry (i.e., *epistemic forms*). For example, Collins and Ferguson described the epistemic game of list-making or classification. This use of the term epistemic games is, in part, an allusion to Wittgenstein's (1953/1992) language games and, in part, stems from the observation that, similarly to games, patterns of inquiry involve goals, rules, moves, and outcomes (Collins & Ferguson, 1993; Perkins, 1997). It is, however, important to note that this reference to games is nonetheless metaphorical: Inquiry patterns are not games per se, as they lack a key defining quality of games—their artificiality or separation from ordinary life<sup>1</sup> (Caillois, 2006; Huizinga, 1944/1980; Salen & Zimmerman, 2004).

<sup>1</sup> Games are separate from ordinary life in the sense that the meanings of objects and actions in a game can differ from their "real life" meanings (Salen & Zimmerman, 2004). Games also need not have real-world consequences (Juul, 2011). Other elements of game definitions, such as rules, conflict, and outcomes (Salen & Zimmerman, 2004), may apply to inquiry as well.

A second use of the term epistemic games in the literature was proposed by Shaffer (2006a, 2006b). In a nutshell, according to Shaffer, epistemic games are role-playing games that introduce real-world ways of knowing, particularly, professional ways of knowing. Shaffer and his colleagues demonstrated that such epistemic games enable players to assume professional roles, such as urban planners or journalists, which involve particular ways of thinking and knowing, which entail the knowledge, skills, values, identity, and epistemology of a profession (e.g., Bagley & Shaffer, 2011; Shaffer, 2006b). Shaffer's notion of epistemic games is holistic and encompasses not only epistemic issues but also conceptual knowledge and professional values. In the present study, epistemic thinking is more narrowly construed, in line with current theoretical definitions (Chinn et al., 2011; Hofer, 2016). Additionally, the study is guided by the assumption that epistemic issues are not limited to a particular game genre and may emerge in diverse types of games.

Some evidence that diverse game genres enable epistemic thinking has been found in prior research. For example, Steinkuehler and Duncan (2008) examined the scientific habits of mind exhibited in *World of Warcraft* (Blizzard, 2004) discussion forums. They found that players often engaged in practices such as scientific argumentation and model-based reasoning in order to develop and justify arguments about the game model and about playing strategies. In another study, Squire (2010) investigated how seventh-grade students engaged in an augmented reality game called *Sick at South Beach*. He found that students engaged in evidence-based argumentation as they developed explanations of the causes of illness at a lake beach. To do so, they combined multiple data sources and used these to support or rule out alternative explanations. Both of these studies demonstrate how games can support epistemic strategies for acquiring and justifying knowledge about the game world (see also Barab et al., 2010; Squire & Jan, 2007).

Fewer studies explicitly discussed the nature of players' epistemic understandings, that is, the ways in which players conceive the nature of knowledge and knowing in digital games. Squire and Klopfer (2007) described how students, playing an environmental mystery game with handheld devices, framed the environmental problem as having a single correct answer, which could presumably be found through simple knowledge accumulation. In contrast, in Steinkuehler and Duncan's (2008) study of *World of Warcraft* forums, the majority of the posts were classified as demonstrating an evaluative epistemology, defined as addressing knowledge as an open-ended process of evaluation and argument. The two aforementioned studies suggest that players may adopt particular epistemic approaches to meaning making in games and that these may be related to the design of the game. However, players' fine-grained ideas about the nature of knowledge and knowing in games have not yet been systematically examined.

### 1.3. Theoretical approach for analyzing epistemic thinking

The main theoretical framework adopted in this study is the AIR model proposed by Clark Chinn and his colleagues (Chinn & Rinehart, 2016; Chinn, Rinehart, & Buckland, 2014; Chinn et al., 2011). This model describes three main components of epistemic thinking:

*Epistemic Aims and Value.* Epistemic aims are defined by Chinn, Rinehart, et al. (2014) as goals of cognition and action to achieve epistemic ends. Epistemic ends include not only knowledge but also other epistemic products that are characterized by their representational nature, such as explanations and models. The value that people assign to various epistemic aims affects how they approach the achievement of these aims. For example, people

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