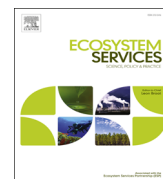




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Simulation games that integrate research, entertainment, and learning around ecosystem services



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ABSTRACT

Humans currently spend over 3 billion person-hours per week playing computer games. Most of these games are purely for entertainment, but use of computer games for education has also expanded dramatically. At the same time, experimental games have become a staple of social science research but have depended on relatively small sample sizes and simple, abstract situations, limiting their range and applicability. If only a fraction of the time spent playing computer games could be harnessed for research, it would open up a huge range of new opportunities. We review the use of games in research, education, and entertainment and develop ideas for integrating these three functions around the idea of ecosystem services valuation. This approach to valuation can be seen as a version of choice modeling that allows players to generate their own scenarios taking account of the trade-offs embedded in the game, rather than simply ranking pre-formed scenarios. We outline a prototype game called “Lagom Island” to test the proposition that gaming can be used to reveal the value of ecosystem services. Our prototype provides a potential pathway and functional building blocks for approaching the relatively untapped potential of games in the context of ecosystem services research.

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1. Introduction

Games have been popular throughout human history to educate and entertain. Even the simplest of games can be thought of as simulations of some aspect of life. Some of these simulations can be

quite complex and useful. Examples include war games and flight simulators. Games that can be used for research to understand some aspect of human behavior have also become quite popular and useful. For example, Von Neumann and Morgenstern (1953) formulated much of economic behavior around “games of strategy.” More recently, the Prisoner’s Dilemma game has been used extensively to understand the evolution of cooperative behavior. A search of the ISI Web of Knowledge for the topic “prisoner’s dilemma” turned up over 1700 papers. The most frequently cited of these was

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the 1981 article by Axelrod and Hamilton (1981). In 2002, Vernon Smith was awarded the Nobel Prize in Economics for his pioneering role in the development of experimental economics, which, in essence, uses simple games to test behavioral responses to different value propositions.

Rapidly advancing technology has provided the increasing ability to bring realistic detail to recreational computer games. Imagine such a game that also offers academically rigorous, peer-reviewed representations of Earth's attributes including human interactions. Millions of players could test and provide solutions to problems that challenge policy analysts, corporate executives, climate scientists, philanthropists, economists, government leaders, sociologists, and scenario planners

The promise of games that integrate research, education and entertainment is huge, but has rarely been achieved. One of the few examples is the "World Game" first developed in 1961 by Buckminster Fuller, originally as a global simulation alternative to war games. The World Game allows a group of players to cooperatively develop a set of global scenarios. The goal is to "make the world work for 100% of humanity in the shortest possible time through spontaneous cooperation without ecological damage or disadvantage to anyone", thus increasing the quality of life for all people. The World Game has been played by thousands of people, with and without the aid of computers over the years. It is now offered by *osearth.com* as a global simulation game for 40 to 600 players in educational workshops. Another recent example is an extension to a very popular board game "Settlers of Catan" called "Catan: Oil Springs" (Griswold, 2013).

We now have the capability to link relatively sophisticated computer simulations with engaging game interfaces over the internet, allowing us to observe and record player behavior. Harvesting such information – or crowdsourcing – from games may help answer both basic and complex research questions, while at the same time entertaining and educating game players. In this paper we outline a novel approach for integrating research, educational and entertainment outcomes within a gaming environment, focusing on and facilitating exploration of the valuation of ecosystem services – that is, on those processes and functions of ecosystems that benefit human society. To date, while some popular games broadly explore aspects of ecosystem science incorporating educational outcomes or could be modified to do so (e.g. SimCity, Civilization, Myst), there is a huge opportunity to better integrate such interfaces with research.

In this paper we review the use of games in research, education, and entertainment and develop ideas for integrating these three functions around the idea of ecosystem services valuation. We start by reviewing the attributes of digital games that allow them to be useful for research, and then explore whether and how games with these attributes could also be made entertaining enough to induce a large number of people to voluntarily play them. This would open up vast new possibilities for social science research. We also explore the educational by-products of such integrated games. We then explore the relationship between the attributes of our hypothetical integrated game and existing games, and the functional attributes that would be needed in games aimed at valuing ecosystem services. We conclude with an outline of a hypothetical game that would satisfy our requirements and sketch the research outcomes that might be expected from such a game.

2. Attributes of digital games for research

There are several attributes that a gaming system should possess in order to simultaneously meet the goals of entertainment, education, and research toward valuing ecosystem services.

Fig. 1 is a conceptual diagram showing the basic elements of an integrated game and the potential research results that such a system might provide. These include insights into human decision-making and valuation of ecosystem services, but also improving our technical ability to link models and game interfaces. There is also the knowledge transfer and educational benefits that individuals will gain from playing the game and that will also influence their behavior in the game (Verutes and Rosenthal, 2014). If the game can be designed as engaging and entertaining enough to get many people to voluntarily play it, then the research and education goals can also be met.

Perhaps the easiest way to start is to describe the criteria for use of the system for research purposes, and then explore whether such an integrated system could also be made entertaining and educational.

2.1. Research on decision-making and valuation

Ecosystem services are defined as the contributions of ecosystems (natural capital) to human well-being (Costanza et al., 1997; Millennium Ecosystem Assessment (MEA), 2005). Valuing ecosystem services is complex and difficult. It requires assessing the relative contribution of natural capital to human well-being, in interaction with the other three major forms of capital – built, human, and social (Fig. 2). It is therefore inherently a transdisciplinary endeavor. Valuation requires both the conveying and the collection of information from many people. Gaming offers the opportunity to do this for a larger and broader cross-section of the population than typical valuation approaches.



Fig. 1. A framework for the use of gaming for landscape research.

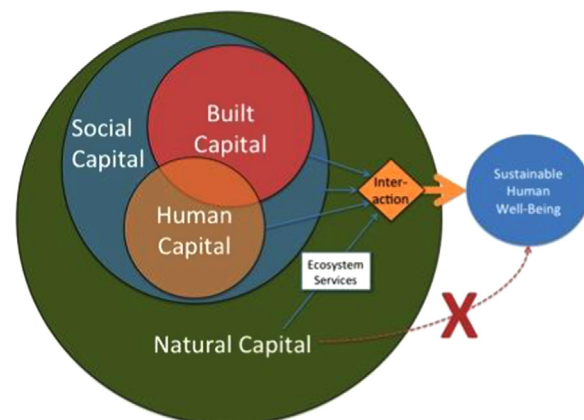


Fig. 2. The interactive contribution of 4 basic types of capital to the production of human well-being.

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