Meaningful Play: The Intersection of Videogames and Environmental Policy

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Abstract: Interactive multi-player simulation games have the potential to provide a more mature and statistically accurate approach to help better understand human behavior in relation to local environments and situated contexts. This could be used as a tool to better inform policy and research around environmental issues such as sustainability, food, and climate change. The Games Learning Society at the University of Wisconsin at Madison is currently working on an ecological simulation game, *Trails Forward.* In this game, three players: a lumber worker, a conservationist, and a housing developer, all work and compete within an accurate model of the Vilas county landscape. *Trails Forward* provides a template of how play in a simulated environment can inform our understandings of human behavior given real-world privileges and restrictions.

A Counterintuitive Model

The ominous threat of global warming, the seemingly irreconcilable tension between the environment and the economy, and the overwhelming immensity of environmental degradation leaves a solemn weight on many of us. In a time of such serious problems, video game play may seem the most counterintuitive savior. But maybe it isn't--in fact video game play may be the one of the things that *can* save us. Videogames can incorporate realistic multivariate simulations of locations, resources, and policy changes in a multiplayer environment. Instead of guessing how social research extrapolates to particular scenarios (such as the introduction of a renewable energy subsidy), video games allow us to preconceive the results of such policies over consecutive trials and foresee the quantitative effectiveness of such policies.

Gaming the system: The historical use of game based interaction to inform environmental policy

The idea of using games to inform environmental policy is not new. Following the advent of Nash's game theory in the 1950's (Nash 1950, 1951), experimental psychologists began reconstructing social dynamics via simplistic game models (Flood 1958; Edney and Harper 1978).

One of the most well known games is the Prisoner's Dilemma (also known as the Flood-Dresher experiment) (Flood 1958; Rapoport & Chammah 1965; Tucker 1983)[1]. This game was used to show that individuals may choose non-cooperation even if it goes against the collective best interest (including their own). In this game two subjects were asked to make a decision to cooperate or defect given a payment system similar to the one listed in table 1. While the actual game typically does not use incremental monetary values, it provides a way to quickly understand the game's dynamics. If both players are rational actors, they will always choose to defect. This is because if person A assumes person B will cooperate, their rational response will be to defect so to get $40 dollars instead of $30. If person A assumes person B will defect, then their rational action is to defect so to get $20 dollars instead of $10. Ironically, when both players act selfishly in their best interests, the total individual gain ($20) is less than that if they were to cooperate ($30). When this game was played with participants, the most likely response was for both participants to defect.

	Person B Coorperates	Person B Defects
Person A Coorperates	Each get $30	Person A gets $10 person B gets $40
Person A Defects	Person A gets $40 person B gets $10	Both get $20

Table 1: Framework of the Prisoner's Dilemma

The Prisoner's Dilemma is a commonly used to back up theories on environmental non-cooperation (Costanza 1987; Soroos 1994). Soroos (1994) argues that the Prisoner's Dilemma may play an important role in global climate change. With reductions to greenhouse gas emissions being perceived as antithetical to economic growth and well being, it may be that the seeming global apathy of climate change may be more indicative of mutual defection from cooperation than apathy of environmental issues. This may stem from a fear that if country A co-operates, country B may defect and gain economic and global power. Indeed during the Kyoto Protocol in 1995, many countries including the United States defensively pointed a finger at middle income countries like China that were considered Non-annex I countries and did not need to make immediate reductions to greenhouse gas emissions. The United States in particular used the 'unfair' growth of the Chinese economy under the 1995 Kyoto Protocol as reason to be the only non-signatory of the protocol (American Society of International Law 2001).

Furthering this understanding of non-cooperation, Hardin's paper, "Tragedy of the Commons" (1968) changed the way human interaction with the environment was viewed. The tragedy of the commons is an idea extrapolated from a simple scenario: If there is a common grazing pasture, some individuals will attempt to maximize their gains by putting more head of cattle on the common pasture than is sustainable. Further, although the benefits of putting extra head of cattle are only accrued onto some individuals, the costs are equally accrued onto all users of the commons. The instability of the short term gain is only realized when the poverty of the commons as a whole is realized, and the damage is often irreconcilable.

Once the idea of tragedy of the commons sprouted, several researchers set out to prove its existence and extrapolate on the idea through game based interactions. Edney and Harper (1978) had participants play a game in which players competed to get the most poker chips. The game was simple; every round the pile of community chips was replenished based on the end size of the pile. Every round, each member could chose to take one, two, or three chips from the pile. If all members overused the resource, the resource would eventually be unable to replenish itself, and the community as a whole would be left with less total chips than if all members only took one chip at a time. Moreover if one member took three, while the other took only one, the latter member would be making him or herself less likely to win against the player whom overused the pile. Edney and Harper found that players commonly overused the pile, and did not catch their mistake until it was too late and the resource could not replenish itself any longer.

Since the ideas of tragedy of the commons and the Prisoner's Dilemma, there have been tedious attempts to deconstruct exactly what variables reduce acting in self interest against the common good. Milinski, Semmann and Krambeck have argued that reputation can reduce the threat (2002), while Barclay (2003) explains it may be trustworthiness and competitive altruism. But perhaps the most influential bandage to our seeming Achilles' heel of short sighted indulgence is the influence of communication and large-scale regulatory systems (Cross & Guyer 1980; Hardin 1968). As a result, private husbandry of resources has been questioned, and the need for large scale regulation of common resources has become more popular (Costanza 1987).

While these games have undoubtedly been hugely informative, there is a simplicity to them that is a little unnerving. Several researchers have since set out to complicate the simplicity of these original experiments. (Axelrod 1980; Wu & Axelrod 1995; Boyd & Lorberbaum 1987; Faysse 2005). Some (Axelrod 1980; Wu & Axelrod 1995) have tried to better understand the mechanics by running them through computer simulations, others (Faysse 2005) have tried to make the games more realistic by allowing users to create their own rules. Still others (Lorberbaum 1987) have tackled the problem by finding contradictions in the proposed theoretical and evolutionary basis of the observed behaviors during the games.

While the tragedy of the commons, and the Prisoner's Dilemma have done an excellent job at increasing our understanding of human behavior in relation to shared resources, there are some serious flaws to drawing policy decisions from such simplistic models and moreover extrapolating these simple ideas into very complex policy.

While our understanding of physical processes, like ecological interactions and climate change modeling, have grown more sophisticated with technology, our understandings of *human* interaction with policy and the environment have continued to rely on understandings that are decades old. With the growing popularity of participatory policy making (O'Fallon & Dearry 2002; Hove 1999), some such as HENVINET (www.henvinet.eu) have tried to use technology to create meaningful participatory channels for activists to raise their voices in government (Grossberndt, Hazel & Bartonova 2012). While these novel uses of technology have been great for creating participatory networks for environmental activism, little technological innovations have been used to understand human interaction with policy and the environment *quantitatively.*

Videogames and the new era of quantitative resource modeling

At Games Learning Society at the University of Wisconsin-Madison, an ecological simulation game, *Trails Forward,* is being developed. This game may provide an introductory template to games based research that may help spur growth in the field, particularly in understanding human-environment interactions.

Trails Forward is a turn-based ecological multiplayer strategy game based in the Vilas county landscape. In this game, three players: a logger, a conservationist, and a housing developer, all work and compete within an accurate model of the Vilas county landscape. In this game players have sophisticated ways to enact their roles and use the land. For instance as a logger, the player has the ability to make several different kind of tree cuts (clear cut, diameter limit, and Q-ratio). Moreover all of the players have ways in which they can interact and benefit from each other. The logger can have the conservationist survey the land, and the housing developer can join a contract with the logger in order to utilize the cleared land for development. Finally, the map used in the game is taken directly from topographical data from the Vilas county landscape. That means the trees, water, and land, are all representative of the real landscape in Vilas county Wisconsin. The design for this game was created through the culmination of interviews with professionals in the field. For instance detailed interviews were conducted with the Department of Natural Resources and local loggers.

Figure 1: **Trails Forward Screenshot**

One of the major critiques of past experiments with traditional game theory is that it is hard to tell if the observed behavior from such experimental contexts can be considered valid. In other words, the controlled setting of these experiments may be too far removed from realistic settings to make any valid real world inferences from them. In *Trails Forward*, the environment is structured to support experimental control, but also has enough fluidity for human based interaction and change. *Trails Forward* provides a way to study traditional game theory within a more accurate and realistic context. As with traditional game theory experiments, *Trails Forward* provides a space in which players have competing interests, but can also benefit from cooperation. However, *Trails Forward* differs by providing accurate multivariate environments as its game space. Moreover, the roles for each player in *Trails Forward* were developed through rounds of in-depth interviews with the Department of Natural Resources and local workers. This was done to get an accurate depiction of the real-world restrictions and privileges of the represented roles, so to make the interaction of these roles in the game space as realistic as possible. Further, *Trails Forward* is situated within an accurate map of Vilas County in Wisconsin. Thus, It is situated, albeit virtually, within the actual geographical location of interest. As such, the results of observed behavior in the game space have more tangible extrapolations into real world.

What is perhaps most intriguing about using *Trails Forward* and other videogames for research, is that they have the capacity for effortless data extraction throughout the game play experience. One example of how such data could be used would be to look at resource consumption in trials pre and post policy implementation. The percentage of total resources can be tallied at the end of each cycle of game play (end resources/beginning resources) and then a confidence interval of percent resource use after game play can be gathered over several trials. In the case of *Trails Forward,* one could construct a confidence interval of resource use over a series of trials, and then compare that interval to one run when a new environmental policy is introduced to the players.

Furthermore, games like *Trails Forward* could be developed as templates where resources and land maps can be loaded into the game to examine the area of interest. For instance, instead of tree resources in Vila's County, a map the United States could be loaded with natural gas as the resource instead of trees.

To better understand if game play in *Trails Forward* provides reliable data, the distribution of end resources should be charted. If end resources fall within a relatively narrow confidence interval over a large series of trials (e.g. n=100), then it is more likely that as a research tool, *Trails Forward* is reliable. Moreover it would make it more likely that a significant difference in data pre and post policy would not be by chance.

To further the validity of research based games, a simulation of past environments (e.g. United States in 1972 before and after the introduction of the Clean Water Act) should be conducted. If such trials tend to repeat history with some accuracy, it is more likely that the claims we are making about the future are also valid.

Game based policy research is not perfect. *Trails Forward* is still a simulation, and as such the risks and consquences that happen in gameplay cannot compete with the immensity of real life consequences. However, games are unique in that they provide an immersive environment where participants feel compelled to react to risks and consequences, even if they are digital.

Moreover there is hopeful evidence that game based interactions, even when simplified, tend to follow past historical trends. One intriguing piece from Squire's (2011) extensive work with the game *Civilization III* in classroom settings is how history tended to repeat itself in gameplay (p. 27-28). In the game *Civilization*, players start at the beginning of human civilization and work to expand their civilization throughout the game. Each location has simplified but geographically accurate resources. Examples of resources include coal, horses, iron, and oil. Players can utilize resources and progress their civilization through investment in science, culture, technology etc. Given the distribution of resources along with the geography of the land, gameplay often re-enacts history. In many cases it is actually hard to play in a way that contradicts major components of history. For instance, the history of colonialism by European countries is hard to skirt. With access to horses, pan European-Asian trade networks, and population density, Europe commonly seeks to disperse its growing population into other colonies, and has the technological upper hand to do so. Germany particularly tends to be a violent nation due to its central location and outer population density, while India by contrast tends to be relatively peaceful (closed borders). While Civilization III is an extremely simplified version of the world, the realism of its variables often causes gameplay strategies and outcomes that align with history. Realizing that a commercial game has the capacity to give so much insight into our past is astounding. Civilization III has allowed children to understand history in ways that only some of the world's greatest thinkers used to understand. Technology and videogames in particular, have such potential to enrich human understandings of past and future phenomena, and to understand complex environment-human interactions. Perhaps, our greatest discoveries yet will come when we are able to glean the same insights about the future as we are able to from the past.

There is no doubt that we stand at the crux of many important decisions to come. Indeed, our generation may be one of the few with the chance to save the world. While sometimes it is easy to see all of the damage technology has wrought, there are such phenomenal innovations and abilities that technology can bring. Innovations that generations before us could never have fathomed. To think, if we can make children understand history in a way that samples the complexity of Karl Marx's genius just from playing a game, what possibilities might we encounter when we use these very tools to understand our future.

Let's play a game.

Endnotes

(1) The origins of the Prisoner's Dilemma are somewhat hard to track. The original experiment was done by Merrill Flood and Melvin Dresher through the RAND cooperation 1950 without formal publishing. Albert Tucker later worked to make the Prisoner's Dilemma more assessable to Stanford psychologists and is credited with coining the term 'Prisoner's Dilemma'. The idea spread without any formal published document, and so many of the citations sur-

rounding the Prisoner's Dilemma do not point back to a formal first publication.

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