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Diversity

Online multiplayer games as virtual laboratories for collecting data on social-ecological decision making

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Introduction

In the Anthropocene, human actions affect the persistence and abundance of nearly all critical natural resources, including the biodiversity on which indispensable ecosystem services depend (Dirzo et al. 2014; Ellis 2019). Sustaining these resources is of global importance for humanity because all humans rely on them to subsist and thrive. Yet, natural resource management has become a difficult, seemingly intractable, challenge (Defries & Nagendra 2017). This is partly caused by an inability to accurately predict social dynamics within social-ecological systems, especially in systems where conflict exists between the interests of human livelihoods and long-term conservation. In such systems, decisions are made by multiple interacting stakeholders with unique and potentially conflicting values, interests, and objectives (Redpath et al. 2013, 2018). To better predict social dynamics in these systems, new tools are needed that can manage the complexity underlying the causes and consequences of human decision making.

Games are valuable tools for studying human decision making (Chabris 2017; Vermillion et al. 2017; Reddie et al. 2018) and are increasingly being used in social-ecological research (Garcia et al. 2016, 2020; Villamor & Badmos 2016). Games have unique advantages and limitations (Redpath et al. 2018), but a thoughtful application of games can ultimately allow researchers to better understand how people make strategic decisions in complex situations involving trade-offs, conflict, and uncertainty. Developing, coordinating, and collecting data from research games often require considerable time investment and technical skill (Redpath et al. 2018). This includes time spent recruiting players and building physical game pieces (for table top games; e.g., Garcia et al. 2020) or developing software (for computer games; Janssen et al. 2014). For computer games, even researchers who are experienced programmers do not typically have the technical skill or expertise necessary to apply game graphics or game play mechanics on par with professional game developers. Harnessing such expertise could drastically increase the scale and complexity of questions that could be addressed and data that could be collected in social-ecological research games. The technology to do this exists in commercially successful computer games, as does an audience for games involving social-ecological decision making (Burroughs 2014; Del-Moral Pérez & Guzmán-Duque 2014). The time is ripe to take these games seriously as an opportunity for improving research game development, data collection, social-ecological models, and ultimately real-world solutions. We envision an open-source platform with a graphical user interface that researchers can use for game development, deployment, and data collection.

Game Development for Social-Ecological Researchers

Open-ended online social videogames (hereafter videogames) provide immersive simulated environments

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for millions of players worldwide (e.g., Burroughs 2014; Del-Moral Pérez & Guzmán-Duque 2014). This genre of games differs from what some might think of as a stereotypical videogame, so it is important to clarify what we mean. Open-ended games can continue indefinitely (players save progress and return to them as desired), and there are no set objectives or requirements beyond those which players create for themselves. There is no winning or losing. Instead, playing is primarily a creative process of building something new from an initially empty state. This process could be creating a fictional character that the player embodies or building a city or farm from an empty simulated landscape that develops over the course of days, months, or even years (Burroughs 2014; Del-Moral Pérez & Guzmán-Duque 2014). Such development might be initially restricted by in-game barriers that must be gradually overcome (e.g., accruing sufficient in-game currency, production metrics, or tools through consequences of game play decisions). This can incentivize players to pursue specific in-game goals, as can social pressure from other players, but doing so is not a game requirement. Videogames, such as SimCity, FarmVille, and CityVille, have tens of millions of players (Burroughs 2014; Del-Moral Pérez & Guzmán-Duque 2014). Nevertheless, their potential in social-ecological research remains unexplored.

Building professional quality videogames from scratch is not feasible for most researchers, but it also should not have to be necessary. Commonly used elements of research games (e.g., graphics, game objects, player interface, and game play options) could be developed and packaged as software for researchers to build their own custom game environments and rules from a common graphical interface. This type of world editor tool already exists in popular videogames (e.g., SimCity and Minecraft) and could be refined for a research gaming context. Researchers could generate their own maps with abiotic and biotic environments, specify player communication rules and available player actions, or set schedules for in-game events (e.g., biological invasions and natural disasters). Once game conditions are specified, game play could occur remotely or in the laboratory, and detailed data on player decision making could be collected automatically. This software would greatly improve game quality and accessibility for researchers because currently available research platforms do not offer the same quality of graphics or game mechanics for experimental games as exist in commercial games. Customization of experimental games with existing software also typically requires at least some coding (Janssen et al. 2014; Chan et al. 2019). Investing in a professionally developed, standardized, point-and-click game development software would, therefore, have wide-ranging benefits for researchers, facilitating the collection of decision-making data and parameterization of social-ecological models.

Data Collection and Application to Social-Ecological Models

The videogame platform that we propose could be used to efficiently create complex game designs and automate data collection in game sessions as they are currently conducted in social-ecological research. But this platform could also be used to deploy free and open online games allowing for game play on an unprecedented scale (e.g., Burroughs 2014; Del-Moral Pérez & Guzmán-Duque 2014). Realistic in-game ecological dynamics would allow for social-ecological feedbacks as thousands of players develop and maintain their own virtual lands, interact with virtual neighbors, and respond to in-game challenges (e.g., resource depletion, disease outbreaks, and extreme events). For example, some virtual areas of the game environment might experience a local outbreak of agricultural pests, incentivizing players to respond by changing their land use, creating parks, constructing deterrents (e.g., fences), or direct action (e.g., scaring or culling). Other virtual areas might contain valuable resources or high biodiversity, which could be exploited for profit or conserved. Player decisions might affect long-term ecological dynamics and resource sustainability and positively or negatively affect in-game neighbors in ways that result in cooperation or conflict. The end result would be a rich source of decision-making data collected from in silico seminatural field experiments (Chabris 2017), which could be used for both statistical inference and social-ecological model parameterization.

To ensure high-quality data, decision-making environments would need to be complex, and players would need to be invested in their decisions. Hence, in contrast to popular commercial video games that often tolerate or outright encourage antisocial behavior for the purpose of entertainment (e.g., violence or recklessness), decisions in research videogames would need to have appropriate in-game consequences. If this were the case, then there is no inherent reason to believe that players would make careless decisions just because they are playing a game. In many videogames, players spend hours or days developing virtual objects, accruing in-game currency, and building within-game social capital (Balnaves et al. 2012). Virtual game objects are often highly valued and are sometimes even considered by players to be priceless (Yee 2006; Livingston et al. 2014). Hence, players are often highly invested in the digital worlds that they create (Lofgren & Feff 2007).

Conclusion

We have outlined a vision for videogames in research that we believe would benefit existing research programmes while simultaneously leading to entirely new avenues for big data collection. Social-ecological researchers could build off of the established popularity and technology of videogames to greatly expand the scale of game complexity, player engagement, and data collection. Big data generated from online games could be applied to suggest novel solutions to real-world problems (e.g., Khatib et al. 2011). Data could also be used to parameterize social-ecological models, which are currently limited in their ability to accurately model complex and goal-oriented human decision making (Schlüter et al. 2012; Duthie et al. 2018). For example, videogame data might be used to build a robust artificial intelligence of stakeholder decision making in agent-based models to better predict biodiversity change across different local land conditions and management policies.

It is critical to recognize that our proposal would present novel ethical challenges for data collection, which would need to be carefully considered before implementing videogames in research (Redpath et al. 2018). Although a full discussion of videogame research ethics is beyond the scope of this paper, it is critical that informed consent be obtained from players whose data are being collected. We also stress the importance of ensuring player privacy and safety and the need to be proactive to ensure that any new game platforms created do not enable hate or harassment or exacerbate existing inequalities.

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