# Seaweed: A Web Application for Designing Economic Games

Lydia B. Chilton, Clayton T. Sims, Max Goldman, Greg Little, Robert C. Miller
MIT CSAIL
32 Vassar St
Cambridge, MA 02139 USA

{hmslydia, ctsims, maxg, glittle, rcm}@mit.edu

## ABSTRACT
Seaweed is a web application for experimental economists with no programming background to design two-player symmetric games in a visual-oriented interface. Games are automatically published to the web where players can play against each other remotely and game play is logged so that the game's designer can analyze the data. The design and implementation challenge in Seaweed is to provide an end user programming environment that creates games responsive to events and controlled by logic without the designer understanding programming concepts such as events and synchronization, or being burdened by specifying low-level programming detail. Seaweed achieves this by providing high-level visual representations for variables, control flow, and logic, and by automating behaviors for event handling, synchronization, and function evaluation. Seaweed's evaluation demonstrates that Amazon's Mechanical Turk (MTurk) is a viable platform for forming partnerships between people and paying them to perform cooperative tasks in real-time, cheaply and with high throughput

## Categories and Subject Descriptors
H5.2 [**Information interfaces and presentation**]: User Interfaces – *User-centered design*.

## General Terms
Design, Economics, Experimentation

## Keywords
End-user programming, experimental economics, Mechanical Turk.

## 1. INTRODUCTION
The history of economics is replete with theories based on the assumption that people behave rationally. Game theory, in particular, is a branch of economics that models how rational players interact directly in small groups rather than indirectly in large economies. Experimental economists are now aggressively challenging the relevance of theory by investigating how small numbers of people actually behave in games. Some of the major results in experimental economics surround the notion that cooperation plays an important role in economic interaction. Even though competitive strategies are more rational, cooperation actually pays off better.


*KDD-HCOMP'09*, June 28, 2009, Paris, France. Copyright 2009 ACM 978-1-60558-672-4...$5.00

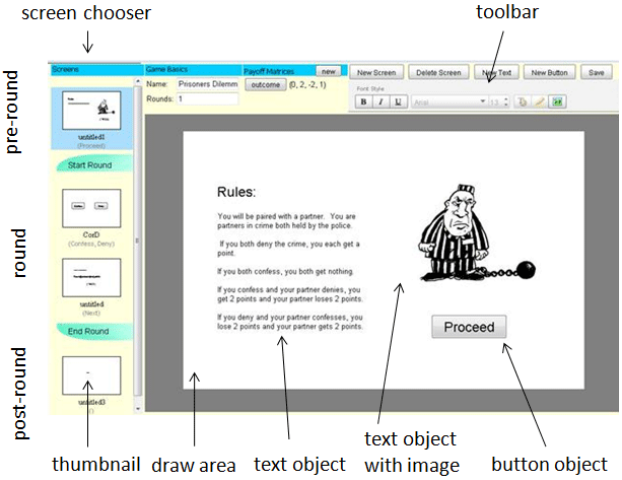


**Figure 1 Interface for designing games.**

In order to remove the technical and logistical burdens of creating games and running experiments, economists need an application where they can program their own games and then deploy them immediately to the web, where thousands of people can play them in a very short time.

Economic games tend to be simple, with limited choices for each player. The familiar children's game "Rock Paper Scissors" is perhaps the simplest economic game. Prisoner's Dilemma is also simple. In Prisoner's Dilemma, two players play a coordination game where they separately decide to cooperate or defect. Even in a simple game, however, making small changes can produce dramatically different results. Adding a new choice or new payoff structure to Prisoner's Dilemma results in significantly different outcomes, and changes as simple as adding an image to the interface of a game can substantially affect the results [4]. Tailoring a game and deploying it to a new culture has also brought new insights into human cooperative behavior [2][5].

Seaweed is a web application for designing two-player symmetric games with discrete choices. Seaweed has two parts: a designer interface for creating games, and a game engine for running them. The designer interface is similar to PowerPoint, allowing the user to draw the screens of a game (Figure 1). Button objects define the available choices on each screen, and the logic of the game is defined by a payoff matrix. Once designed, the game is stored in database tables on a server, where the game engine can retrieve it

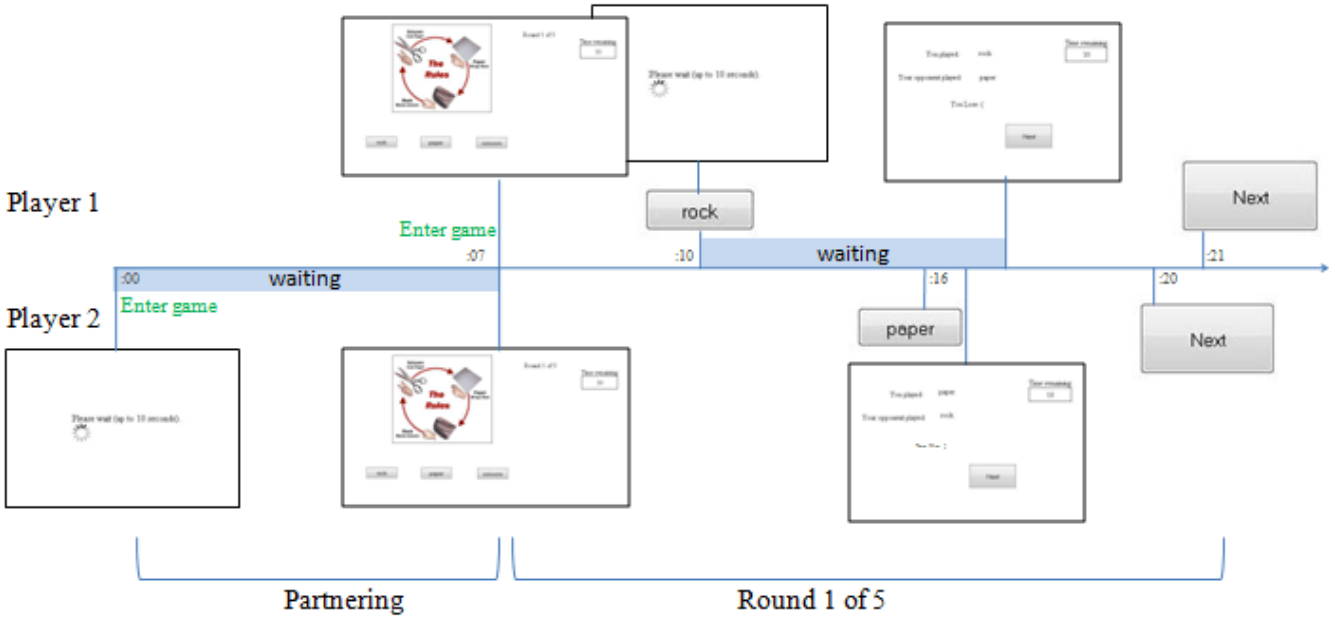


**Figure 2 Two players playing "Rock Paper Scissors" on MTurk.**

and generate instances of the game for pairs of players across the web.

## 2. RELATED WORK

z-Tree[3] is an existing application for economists to create lab-based economic games. Its design is less visual than Seaweed and demands more programming ability of its users. Seaweed's ability to deploy games online sets it apart from z-Tree.

The ESP Game and Peekaboom[1] are games with a purpose that are popular enough such that the system can partner players at any time. Additionally, people will play them for free because they are fun. Economic games have the purpose of collecting data, but they are not games in the sense that they are fun. They are games in the sense that they require strategy. Monetary rewards and the possibility of bonuses are a central feature of economic games.

## 3. DESIGN

Seaweed's approach is to take the programming concepts needed to design economic games and either represent them visually or automate their behavior so the designer never has to think about them. There are six key programming concepts involved in Seaweed: variables, control flow, events, logic, conditionals and synchronization.

## 4. EVALUATION

We evaluated the design interface by asking five economists to fix bugs in and augment a pre-existing game. We evaluated the game engine by posting a game of "Rock Paper Scissors" on MTurk, and were very successful at making partnerships and collecting data. In under four minutes, we got 22 human-human partnerships and 12 human-computer partnerships to play all five rounds of the game for a total of $20.00 (Figure 2). This is a demonstration of high game play through put on MTurk.

## 5. CONCLUSION

The design and implementation challenge in Seaweed is to provide an end user programming environment that creates games responsive to events and controlled by logic without the designer understanding programming concepts such as events and synchronization or being burdened by specifying low-level programming detail. Seaweed achieves this by providing high-level visual representations for variables, control flow, and logic, and by automating behaviors for event handling, synchronization, and function evaluation. Currently, Seaweed can design and deploy two-player, symmetric, games with discrete choices. Using the same design approach, we plan to generalize Seaweed to relax these constraints, allowing multiple players, asymmetric roles, and textual input.

The deployment of Seaweed games on MTurk has demonstrated the efficiency in time and money of running partner-based economic games there. To our knowledge, Seaweed's evaluation demonstrates the first instance of real-time cooperative tasks completed on MTurk.

## 6. REFERENCES

[1] Luis von Ahn. Games With A Purpose. IEEE Computer Mag-azine, June 2006. Pages 96-98.

[2] H. Bernhard, U. Fischbacher and E. Fehr; "Parochial altruism in humans." Nature 442, 24 August 2006, 912-915.

[3] U. Fischbacher, z-Tree: Zurich Toolbox for Ready-made Economic experiments, Experimental Economics, 10(2), 2007, pp.171-178.

[4] K.J. Haley, and D.M.T. Fessler, "Nobody's watching? Subtle cues affect generosity in an anonymous economic game", Evolution and Human Behavior, Vol. 26, No. 3., May 2005, pp. 245-256.

[5] D.P. Tracer, "Market Integration, Reciprocity, and Fairness in Rural Papua New Guinea: Results from a Two-Village Ultimatum Game Experiment."*Foundations of Human Sociality*, 2004, pp. 232-259.